IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): **KAPLAN, Diego** Application Serial No.: **10/091,311** Filed: **March 04, 2002** Title: **SYSTEM AND METHOD FOR OPTIMAL SHORT MESSAGE SERVICE (SMS) ENCODING IN A WIRELESS COMMUNICATION DEVICE**	Group Art Unit: **2152** Examiner: **TRUONG, Lan Dai T.** Conf. No.: **8151**

Mail Stop Appeal Briefs – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPELLANT'S APPEAL BRIEF UNDER 37 CFR §41.37

In accordance with the Notice of Appeal to the Board of Patent Appeals and Interferences mailed on July 25, 2007 and received on July 31, 2007, in the above-identified U.S. Patent application, Appellants hereby present the Appellants' Appeal Brief under 37 CFR §41.37. The APPELLANTS' APPEAL BRIEF is submitted with copies of each reference discussed and a copy of the Final Office Action as well as the appropriate fees required under 37 CFR §41.20(b)(2).

TABLE OF CONTENTS

REAL PARTY IN INTEREST

Kyocera Wireless Corporation of San Diego, California is the real party in interest as the assignee of the above-identified application.

RELATED APPEALS AND INTERFERENCES

No other appeals or interferences are known which will be affected by this appeal.

STATUS OF CLAIMS

Claims 1-10 are cancelled. In the Final Office Action, the Examiner has indicated that claims 11-30 stand finally rejected. The application under appeal includes pending claims 11-30.

Claims 11-17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Lee (US 6,590,887) in view of Moskowitz (US 5,249,220).

Claim 18 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Lee in view of Moskowitz further in view of Wolf (US 5,844,922).

Claims 19-21, 23-24 and 28-30 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kim (US 2001/0049289) in view of Moskowitz.

Claims 26-27 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kim in view of Moskowitz further in view of King (U.S. 5,859,945).

Claim 22 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Kim in view of Moskowitz further in view of Murray (U.S. 6,539,118).

Claim 25 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Kim in view of Moskowitz further in view of Wolf.

STATUS OF AMENDMENTS

The latest amendments to the claims submitted in a Response dated February 07, 2007 have been entered. No other amendments have been submitted since the February 07, 2007 Amendment.

SUMMARY OF CLAIMED SUBJECT MATTER

In accordance with 37 CFR § 41.37(v), Appellant provides a brief summary of each independent claim involved in the appeal, where each summary refers to the specification by page and line number and to the drawings by reference number. Appellant notes that this "Summary of claimed subject matter" is provided only to assist the Board in identifying some portions of the specification related to the particular claims. In the interest of brevity, each claim summary does not necessarily include all references to all relevant portions of the specification and drawings. Accordingly, omission of any reference to the specification or to the drawings should not be construed in any way as an intent to relinquish claim scope, or as an implication or statement regarding the conformance with 35 U.S.C. §112. Appellant respectfully submits that the claims should not be construed as being limited to the embodiments described or referenced in any claim summary, and further submit that other embodiments, as well as the Doctrine of Equivalents, may apply in determining claim scope.

Claim 11

The subject matter of claim 11 is directed to a system (100) for optimal short message service (SMS) character encoding that comprises an optimizing subsystem (102) and a character encoding subsystem (104). (Specification page 6, line 21-Page 7, line 5). The optimizing subsystem (102) has an output to supply an optimizing signal (116) responsive to SMS message character encoding requirements prior to character encoding of the SMS message. (Specification page 6, line 21-Page 7, line 5) The character encoding subsystem (104) has an input (108) to accept the SMS message and input (116) to accept the optimizing signal and an output (116) to supply the SMS message in a character encoding format responsive to the optimizing signal. (Specification page 5, line 23-Page 6, line 3); (Specification page 6, lines 21-Page 7, line 5) and (FIG. 2, step 214 and Specification page 11, lines 19-21).

Claim 19

The subject matter of claim 19 is directed to a method of encoding an SMS message that comprises selecting a SMS character encoding format based on a wireless device resource requirement of an encoded SMS message (208, 210) and encoding the SMS message using the SMS character encoding format (212). (Specification page 11, lines 9-22). The selecting of the character encoding format is performed prior to encoding the SMS message. (Specification page 6, lines 21-Page 7, line 5) and (FIG. 2, step 214 and Specification page 11, lines 19-21).

Claim 28

The subject matter of claim 28 is directed to a Short Message Service (SMS) character encoding system (100) configured to generate an encoded SMS message by encoding a SMS message using a SMS character encoding format. (Specification page 6, lines 21-Page 3, lines 5). Prior to encoding the SMS message, the encoding system selects the SMS character encoding format based on a resource requirement of the encoded SMS message. (FIG. 1 and FIG. 2. Specification, Page 8, Line 16 to Page 9, line 9 and Page 11, lines 19-21).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Appellant wishes the Board of Patent Appeals and Interferences to review the following grounds of rejection on appeal:

1) Grounds of rejection in rejecting claims 11-17 under 35 U.S.C. §103(a) as being as being unpatentable over Lee (US 6,590,887) in view of Moskowitz (US 5,249,220).

2) Grounds of rejection in rejecting claims 19-21, 23-24 and 28-30 under 35 U.S.C. §103(a) as being unpatentable over Kim (US 2001/0049289) in view of Moskowitz.

ARGUMENT

Appellant respectfully submits that claims 11-30 are allowable over the art cited by the Examiner. Each of the issues presented for review are addressed below.

I. REJECTION OF CLAIMS 11-17 UNDER 35 U.S.C. §103(A) - LEE IN VIEW OF MOSKOWITZ IS IMPROPER

The Examiner rejected claim 1-17 under 35 U.S.C. § 103(a) as unpatentable over Lee (US 6,590,887) in view of Moskowitz (US 5,249,220). Appellant respectfully submits that the rejection is improper for at least one of the following reasons:

A) The combination of references does not teach or suggest supplying an optimizing signal "prior to character encoding of the SMS message".

B) The combination of references does not teach or suggest a "character encoding subsystem with an input to accept an SMS message".

C) There is no reasonable expectation of success when combining the references.

Claim 11

A) REJECTION OF CLAIMS 11-17 UNDER 35 U.S.C. §103(A) - LEE IN VIEW OF MOSKOWITZ IS IMPROPER SINCE LEE AND MOSKOWITZ DO NOT TEACH OR SUGGEST SUPPLYING AN OPTIMIZING SIGNAL "PRIOR TO CHARACTER ENCODING OF THE SMS MESSAGE"

The Examiner rejected claim 11 under 35 U.S.C. § 103(a) as unpatentable over Lee (US 6,590,887) in view of Moskowitz (US 5,249,220). In order for a claim to rejected under 35 U.S.C. § 103(a), the prior art references when combined must teach or suggest all the claim limitations. MPEP 2143. Appellant respectfully submits that neither Lee, nor Moskowitz, nor a combination of the two, teaches or suggests every element of claim 11 and that claim 11 is allowable.

Claim 11 recites a system for Short Message Service (SMS) character encoding comprising "an optimizing subsystem with an input to accept an SMS message, an input to accept an evaluation control signal, and an output to supply an optimizing signal responsive to SMS message character encoding requirements prior to character encoding of the SMS message". Appellant respectfully submits that Lee does not teach or suggest this feature. As

stated by the Examiner "Lee does not explicitly disclose an optimizing subsystem which accepts [sic]n message, accepts evaluation control signal and supplies an optimizing signal responsive to message character encoding requirements prior to encoding the message".

Moskowitz explicitly states that the "transmitter encodes the message that is to be sent to the receiver **according to each format**. The format which requires the fewest number of binary bits to represent the entire message is selected as the character encoding format." (Column 12, lines 3-7, emphasis added). Therefore, the message must be encoded prior to selecting the format resulting in the fewest bits and selection of the format is after encoding. This point is emphasized at Col. 13 lines 40-45 where Moskowitz states that transmitter "will have to encode the message according to the five, six and variable-bit encoding methods and determine which is the most efficient mode of transmission, i.e. which mode requires the smallest number of binary bits to represent the message". (Moskowitz, Col. 13, Lines 40-45, emphasis added.) Accordingly, Moskowitz clearly teaches to encode the message to determine the number of bits required to represent the message. The message must be encoded before selecting the encoding format in Moskowitz. Accordingly, Moskowitz does not teach or suggest selecting the format "prior to encoding the SMS message" as claimed.

B) REJECTION OF CLAIMS 11-17 UNDER 35 U.S.C. §103(A) - LEE IN VIEW OF MOSKOWITZ IS IMPROPER SINCE LEE AND MOSKOWITZ DO NOT TEACH AN "CHARACTER ENCODING SUBSYSTEM WITH AN INPUT TO ACCEPT AN SMS MESSAGE"

Claim 11 recites a system for Short Message Service (SMS) character encoding comprising "a character encoding subsystem with an input to accept the SMS message and an input to accept the optimizing signal". Appellant respectfully submits that Lee does not teach or suggest this feature. The encoder/decoder 16 in Lee is a PCS or CDMA chip for signal encoding before modulation and transmission and is not a character encoder. Lee col. 2 lines 39-46. There is no showing of a character encoding subsystem with inputs in Lee. In the Final Office Action dated May 02, 2007, the Examiner asserts that the applicant is arguing limitations not recited in the claims when pointing out that Lee does not show "character encoding". (See Final Office Action, Page 2 line 20 to Page 3 line 4.) The Final Office Action, however, acknowledges the amendments to the claims submitted in the Response filed February 07, 2007. The

amendments clearly indicate that insertion of the term "character" throughout the claims. (See AMENDMENT AND RESPONSE TO OFFICE ACTION submitted 02/07/2007, Page 2). Appellant respectfully submits that "character encoding" is recited in following locations in the claims: claim 11 at line 6-7, line 8 and line 10; claim 12, line 2, claim 13, line 2; claim 14, line 1; claim 18, line 1; claim 19, lines 3 and 5; claim 20 line 2; claim 22, line 1, claim 23, line 2, claim 25, lines 1 and 2; claim 28, lines 1, 3, and 4; claim 29, lines 1, 2, 5, and 7; and at claim 30, line 1. Claims 11-14, 18-20, 22-23, 25, and 28-30 were amended to recite this feature in the Response dated February 07, 2007. (See Pages 2-5, AMENDMENT AND RESPONSE TO OFFICE ACTION submitted 02/07/2007). Accordingly, Appellant respectfully submits that character encoding is recited in the claims.

Moskowitz does not show a character encoding subsystem with an input to accept a SMS message and an input to accept an optimizing signal. Moskowitz teaches a transmitter that encodes a message in each format. Nowhere in Moskowitz is a suggestion that the transmitter includes an input for receiving an optimizing signal. Further, the transmitter in Moskowitz does not encode a message in response to an optimizing signal. Accordingly, Appellant respectfully submits that the neither Lee nor Moskowitz nor a combination of the two, teaches or suggests a character encoding subsystem as claimed.

C. REJECTION OF CLAIMS 11-17 UNDER 35 U.S.C. §103(A) - LEE IN VIEW OF MOSKOWITZ IS IMPROPER SINCE THERE IS NO REASONABLE EXPECTATION OF SUCCESS

In order to meet establish a prima facie case for obviousness, there must be a reasonable expectation of success in combining the references. MPEP § 2143. The prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)

Appellant respectfully submits that the Examiner has not set forth any evidence or reasoning to establish reasonable expectation that Lee and Moskowitz, when combined, will succeed in a character encoding system that will not reduce the amount of resources required for character encoding a SMS message Simply combining the two references results in a system that still experiences the prior art problems of requiring sufficient memory to encode the SMS message in a less efficient format than required. The technique in Moskowitz requires that the SMS message is encoded in each format. Accordingly, a system operating in accordance

with the combination of the two references requires that the SMS message be character encoded in a number of inefficient formats where the number is one less than the total number of available formats. Memory is such a system must be reserved to store the SMS message encoded using the most inefficient format available. The combination of the CDMA encoder discussed in Lee and the message encoder in Moskowitz does not solve efficiency problems associated with a character encoding a SMS message.

Claim 12-17

Claims 12-18 depend from claim 11 which Appellant submits are allowable. Accordingly, claims 12-18 are at least allowable for the reason that they depend from an allowable base claim.

II. REJECTION OF CLAIMS 19-21, 23-24 AND 28-30 UNDER 35 U.S.C. §103(A) - KIM IN VIEW OF MOSKOWITZ IS IMPROPER SINCE KIM AND MOSKOWITZ DO NOT TEACH OR SUGGEST SELECTION OF THE SMS CHARACTER ENCODING FORMAT PERFORMED "PRIOR TO CHARACTER ENCODING OF THE SMS MESSAGE"

The Examiner rejected claims 19-21, 23-24, and 28-30 under 35 U.S.C. § 103(a) as unpatentable over Kim (2001/0049289) in view of Moskowitz. Appellant respectfully submits that neither Kim, nor Moskowitz, nor a combination of the two, teaches or suggests every element of any one of claims 19-21, 23-24 and 28-30 and that these claims are allowable.

Claim 12-17

Independent claim 19 recites a method of character encoding a SMS message comprising "prior to encoding the SMS message, selecting the SMS character encoding format based on a wireless device resource requirement of the encoded SMS message". Appellant respectfully submits Moskowitz does not teach or suggest this step. Moskowitz explicitly states that the "transmitter encodes the message that is to be sent to the receiver **according to each format**. The format which requires the fewest number of binary bits to represent the entire message is selected as the character encoding format" (Column 12 lines 3-7, emphasis added). Therefore, the message must be encoded prior to selecting the format resulting in the fewest bits. Moskowitz provides no technique other than encoding the message in each format to determine the number of bits required for the encoding the message. Accordingly, the message

must be encoded prior to selecting the format in order to select the format that results in the fewest bits.

Appellant respectfully submits that Kim does not teach or suggest selecting a character encoding format. Kim discloses a system for encoding graphics in an SMS message and discusses indicating whether the SMS data represents graphics or where the SMS data represents text. The character encoding format is the same for both types of transmissions except that the SMS character data represents lines, curved lines and polygons. (See Kim, [0026] and [0027]). Accordingly, Kim does not teach or suggest selecting a character encoding format prior to encoding a SMS message.

Claim 28

Independent claim 28 recites "a Short Message Service (SMS) character encoding system configured to generate an encoded SMS message by encoding a SMS message using a SMS character encoding format and, prior to encoding the SMS message, selecting the SMS character encoding format based on a resource requirement of the encoded SMS message". As discussed above, neither Moskowitz, nor Kim, nor a combination of the two, teaches or suggests selecting a SMS character encoding format prior to encoding an SMS message. Accordingly, Appellant respectfully submits that the combination of references does not teach or suggest every element of claim 28 and that claim 28 is allowable.

Claims 20-27 and 29-30

Claims 20-27, and 29-30 depend from either claim 19 or claim 28 which Appellant submits are allowable. Accordingly, claims 20-27 and 29-30 are at least allowable for the reason that they depend from an allowable base claim.

Conclusion

Appellant respectfully submits that the pending claims are allowable and that the rejections should be reversed.

Respectfully Submitted,

Dated: September 24, 2007

/George W. Luckhardt/
George W. Luckhardt
Reg. No. 50,519

George W. Luckhardt
Kyocera Wireless Corp.
Attn: Patent Department
P.O. Box 928289
San Diego, California 92192-8289
Tel: (858) 882-2593
Fax: (858) 882-2485

APPENDIX
Claims

11. A system for optimal Short Message Service (SMS) character encoding in a wireless communications device having SMS capabilities, the system comprising:

an optimizing subsystem with an input to accept an SMS message, an input to accept an evaluation control signal, and an output to supply an optimizing signal responsive to SMS message character encoding requirements prior to character encoding of the SMS message; and

a character encoding subsystem with an input to accept the SMS message, an input to accept the optimizing signal, and an output to supply the SMS message in a character encoding format responsive to the optimizing signal.

12. The system of claim 11 wherein the evaluation control signal identifies character encoding formats available in the wireless communication device and available encoding format parameters including the number of bits needed to represent characters.

13. The system of claim 12 wherein the optimizing subsystem is configured to: evaluates the SMS message to identify the available character encoding formats usable for encoding the characters, determine a memory usage requirement select, as the optimal encoding format, a usable format with a minimum memory usage, and supply the identity of the optimal encoding format in the optimizing signal.

14. The system of claim 13 wherein the character encoding subsystem is configured to encode the SMS message in the optimal encoding format to generate an encoded SMS message and is further configured to supply the encoded SMS message at an output.

15. The system of claim 14 further comprising: a memory circuit having an input to accept the encoded SMS message for storage and having an output to supply the stored SMS message.

16. The system of claim 15 wherein the wireless device is Mobile Origination enabled and the optimizing subsystem accepts the SMS message from a user interface, the system further comprising:

a transceiver having an input to accept the stored SMS message from the memory circuit for airlink transmission.

17. The system of claim 15 wherein the transceiver is configured to accept an airlink communication including an SMS message and the optimizing subsystem is configured to accept the SMS message from the transceiver,

the system further comprising a user interface having an input to accept the stored SMS message for presentation.

18. The system of claim 15 wherein the character encoding subsystem uses seven-bit ASCII as a default optimal encoding format.

19. A method of encoding a Short Message Service (SMS) message, the method comprising:

encoding a SMS message using a SMS character encoding format to generate an encoded SMS message; and

prior to encoding the SMS message, selecting the SMS character encoding format based on a wireless device resource requirement of the encoded SMS message.

20. The method of claim 19, wherein the selecting comprises selecting the SMS character encoding format from a plurality of available encoding formats supported by a wireless communication device.

21. The method of claim 20, further comprising:

identifying the SMS character encoding format as usable for encoding the SMS message.

22. The method of claim 21 wherein identifying the SMS character encoding format as usable for encoding the SMS message comprises:

evaluating an English-language SMS message;

identifying seven-bit ASCII, IS0 Latin 1, and Unicode formats as usable;

determining a number of bits needed to represent characters in the seven-bit ASCII, IS0 Latin 1, and Unicode formats; and

selecting the seven-bit ASCII format as the SMS encoding format.

23. The method of claim 21, wherein the identifying the SMS character encoding format comprises determining a number of bits needed to represent characters in the available encoding format.

24. The method of claim 20, further comprising determining a memory usage requirement of the encoded SMS message.

25. The method of claim 20, wherein selecting the SMS character encoding format comprises selecting seven-bit ASCII as a default SMS character encoding format.

26. The method of claim 19, further comprising:

receiving the SMS message at a Mobile Origination enabled wireless device via a user interface; and

storing the SMS encoded message.

27. The method of claim 19, further comprising:

receiving the SMS message at a Mobile Origination enabled wireless device via a user interface; and

transmitting the encoded SMS message.

28. A Short Message Service (SMS) character encoding system configured to generate an encoded SMS message by encoding a SMS message using a SMS character encoding format and, prior to encoding the SMS message, selecting the SMS character encoding format based on a resource requirement of the encoded SMS message.

29. The SMS encoding system of claim 28, comprising:

a character encoding subsystem comprising an input for receiving a signal indicating the SMS character encoding format, the encoding subsystem configured to encode the SMS message in accordance with the signal; and

an optimizing subsystem configured to identify, prior to encoding of the SMS message, the SMS character encoding format from a plurality of SMS character encoding formats based on resources requirements corresponding to encoding the SMS message for each of the plurality of SMS character encoding formats, the optimizing subsystem comprising an output for generating the signal.

30. The SMS character encoding system of claim 29, wherein the resource requirement is an amount of memory required to store the encoded SMS message.

APPENDIX

Evidence

1) US Patent No. 6,590,887 (Lee)

2) US Patent No. 5,249,220 (Moskowitz)

3) US Patent Pub. No. 2001/0049289 (Kim)

4) Final Office Action dated May 02, 2007

US006590887B1

(12) **United States Patent**
Lee

(10) **Patent No.: US 6,590,887 B1**
(45) **Date of Patent: Jul. 8, 2003**

(54) **METHOD FOR TRANSMITTING SHORT MESSAGE IN DIGITAL MOBILE COMMUNICATION TERMINAL WITH SHORT MESSAGE SERVICE FUNCTION**

(75) Inventor: **Hye-Young Lee**, Seoul (KR)

(73) Assignee: **Samsung Electronics Co., Ltd.** (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/143,478**

(22) Filed: **Aug. 28, 1998**

(30) **Foreign Application Priority Data**

Aug. 28, 1997 (KR) 97-41867

(51) **Int. Cl.**[7] **H04B 7/216**
(52) **U.S. Cl.** **370/342**; 370/441
(58) **Field of Search** 370/335, 342, 370/320, 441; 455/466

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,668,880 A * 9/1997 Alajajian 380/49
5,692,032 A * 11/1997 Seppanen et al. 379/59
5,943,399 A * 8/1999 Bannister et al. 379/88.17
6,097,961 A * 8/2000 Alanara et al. 455/466
6,301,338 B1 * 10/2001 Makela et al. 379/88.21

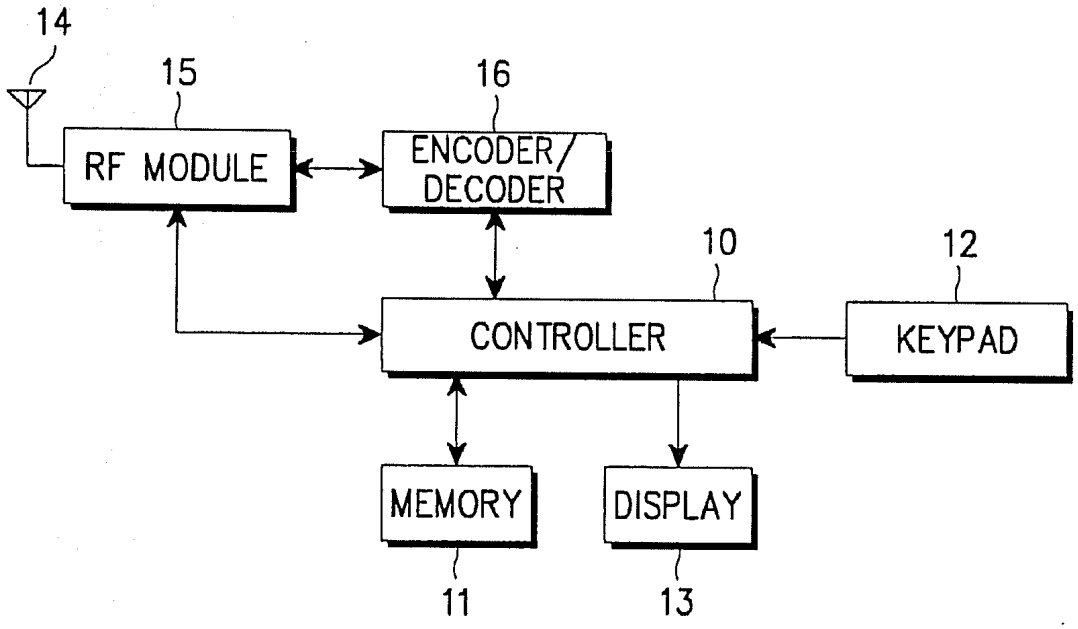
* cited by examiner

Primary Examiner—Alpus H. Hsu
Assistant Examiner—Toan Nguyen
(74) *Attorney, Agent, or Firm*—Dilworth & Barrese, LLP

(57) **ABSTRACT**

A digital mobile communication terminal with a SMS (Short Message Service) function stores user predefined messages which are frequently used and transmits a short message by using the user predefined messages. The communication terminal determines whether a short message transmission mode is set through a user interface and determines whether a user predefined message using mode is set, if the short message transmission mode is set. The user predefined messages are read in sequence from the memory and displayed on a display, if the user predefined message using mode is set. Subsequently, a selected one of the user predefined messages is displayed and edited according to edit data or input data received from the user interface. After editing the short message, the communication terminal transmits the edited short message to a designated telephone number.

9 Claims, 3 Drawing Sheets



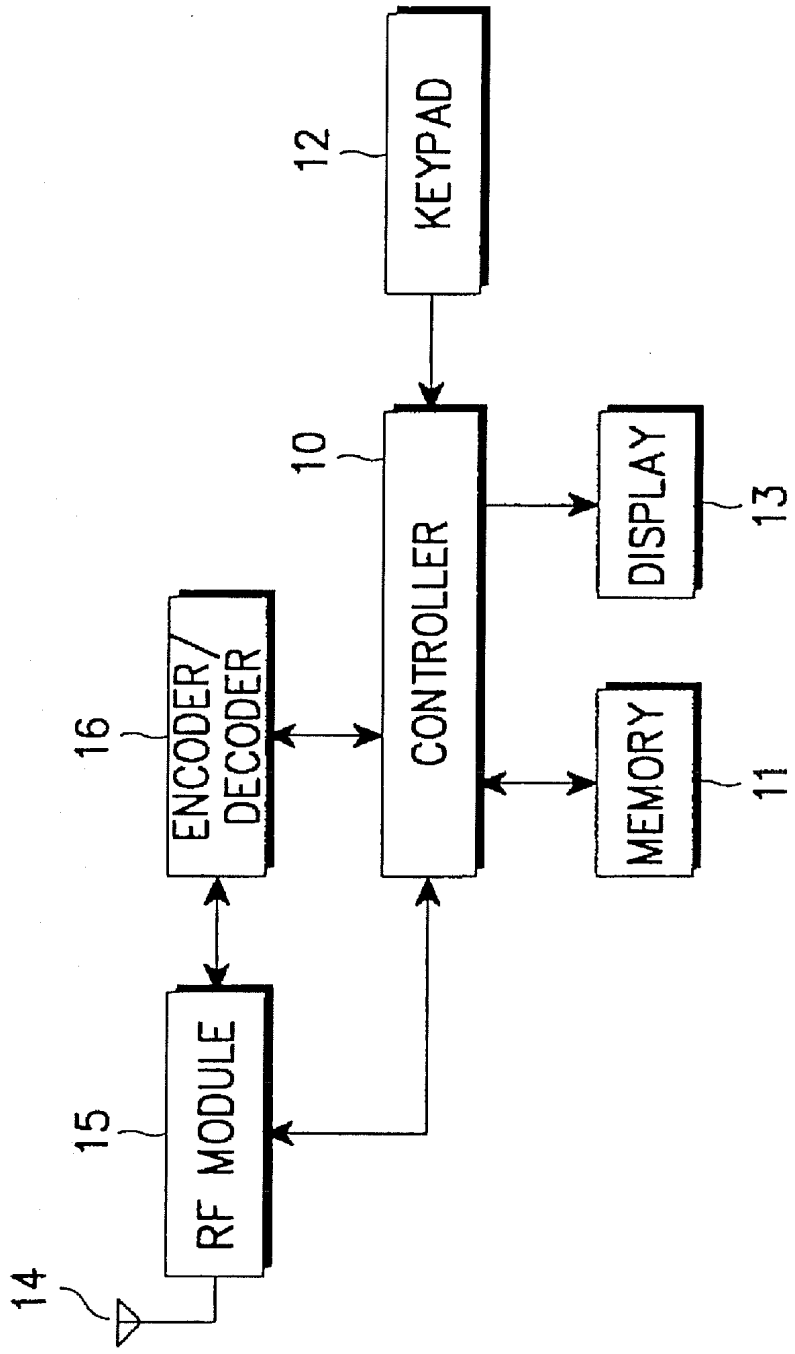

12
KEYPAD
10
CONTROLLER
DISPLAY
13
MEMORY
11
16
ENCODER/
DECODER
15
RF MODULE
14

FIG. 1

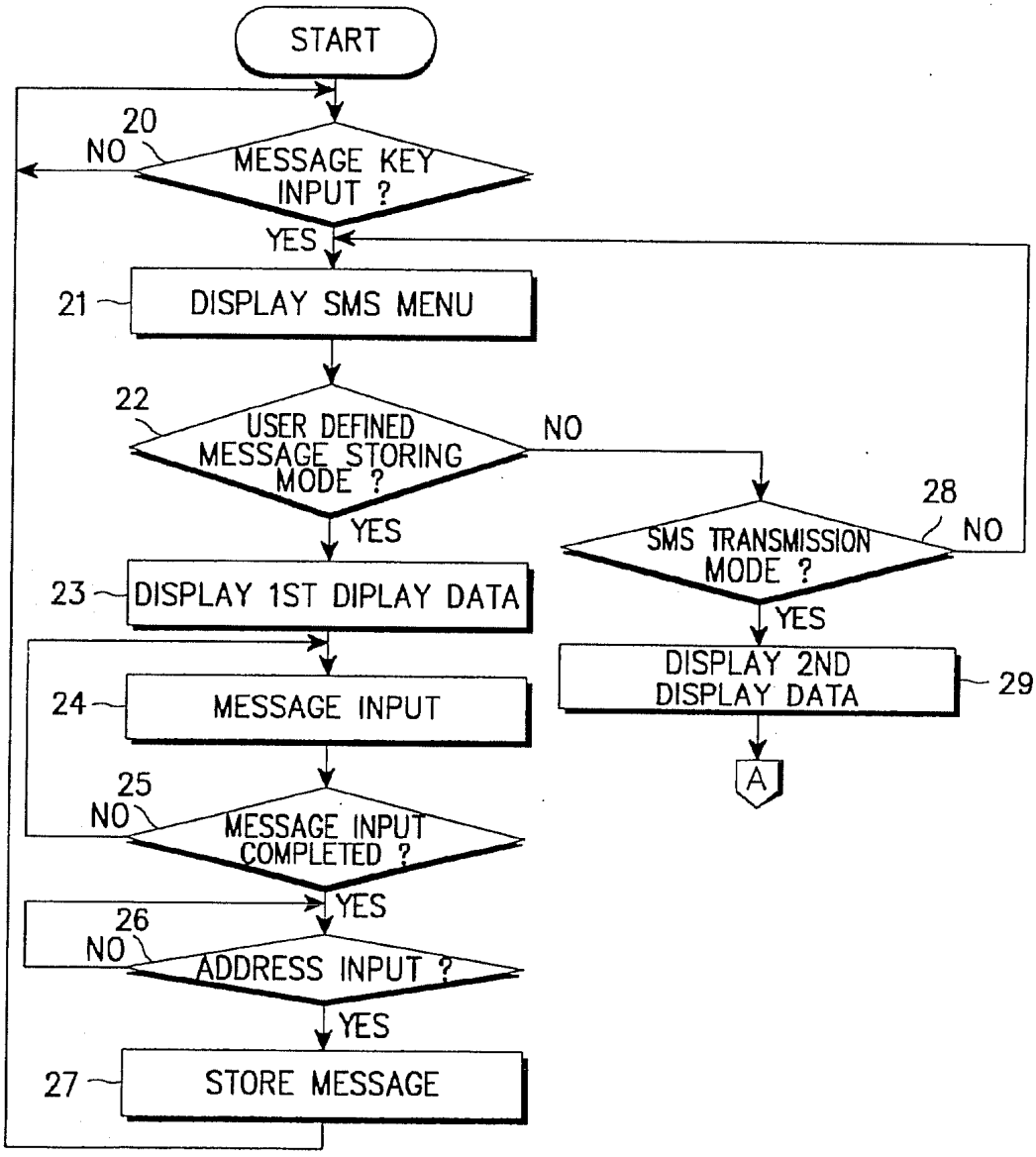

START
20
NO
MESSAGE KEY INPUT ?
YES
21
DISPLAY SMS MENU
22
USER DEFINED MESSAGE STORING MODE ?
NO
YES
28
SMS TRANSMISSION MODE ?
NO
YES
23
DISPLAY 1ST DIPLAY DATA
DISPLAY 2ND DISPLAY DATA
29
24
MESSAGE INPUT
A
25
NO
MESSAGE INPUT COMPLETED ?
YES
26
NO
ADDRESS INPUT ?
YES
27
STORE MESSAGE

FIG. 2A

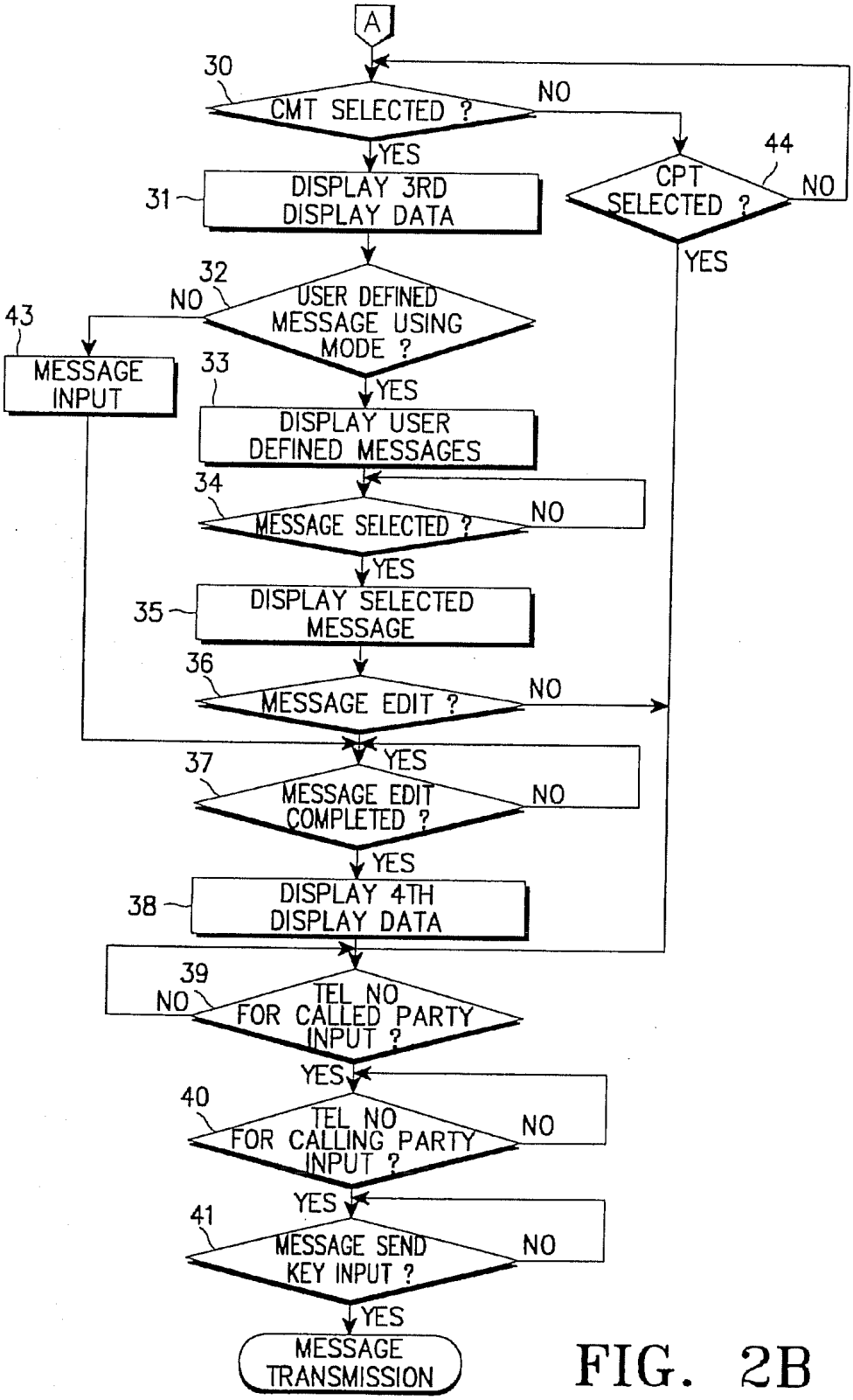

A
30
CMT SELECTED ?
NO
YES
44
CPT SELECTED ?
NO
YES
31
DISPLAY 3RD DISPLAY DATA
32
NO
USER DEFINED MESSAGE USING MODE ?
43
MESSAGE INPUT
33
YES
DISPLAY USER DEFINED MESSAGES
34
MESSAGE SELECTED ?
NO
YES
35
DISPLAY SELECTED MESSAGE
36
MESSAGE EDIT ?
NO
YES
37
MESSAGE EDIT COMPLETED ?
NO
YES
38
DISPLAY 4TH DISPLAY DATA
39
NO
TEL NO FOR CALLED PARTY INPUT ?
YES
40
TEL NO FOR CALLING PARTY INPUT ?
NO
YES
41
MESSAGE SEND KEY INPUT ?
NO
YES
MESSAGE TRANSMISSION

FIG. 2B

METHOD FOR TRANSMITTING SHORT MESSAGE IN DIGITAL MOBILE COMMUNICATION TERMINAL WITH SHORT MESSAGE SERVICE FUNCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a short message service function of a mobile communication terminal such as a CDMA (Code Division Multiple Access) or PCS (Personal Communication Services) terminal, and in particular, to a method for transmitting a short message using user predefined messages.

2. Description of the Related Art

In a conventional digital mobile communication terminal with a short message service (SMS) function, a user of the terminal inputs a short message every time he or she transmits the short message. Usually, the digital mobile communication terminal does not have character keys for exclusive use of the SMS function, thus requiring the user to press numeric keys several times to input a specific character message.

Accordingly, the user must manipulate the keys several times to transmit even a short message, which is annoying and wastes time. As a result of this inconvenience, the user may avoid using the SMS function.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method for use in a digital mobile communication terminal with an SMS function for storing user predefined messages which are frequently used and transmitting a short message by using the user predefined messages.

To achieve the above object, the present invention provides a method for transmitting a short message in a digital mobile communication terminal having a memory in which user predefined messages are stored. The communication terminal determines whether a short message transmission mode is set through a user interface and if the short message transmission mode is set, the terminal then determines whether a user predefined message using mode is set. If the user predefined message using mode is set, the user predefined messages are then read from the memory and displayed on a display. Subsequently, a selected one of the user predefined messages is displayed and edited according to edit data or input data received from the user interface. After the short message is edited, the communication terminal transmits the edited short message to a designated telephone number.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram of a digital mobile communication terminal applied to the present invention; and

FIGS. 2A and 2B are flow charts illustrating the procedure of transmitting a short message according to an embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Preferred embodiments of the present invention will be described in detail hereinbelow with reference to the accompanying drawings. In the following description, numerous specific details are set forth to provide a more thorough understanding of the present invention. It will be apparent, however, to one skilled in the art that the present invention may be practiced without these specific details. In other instances, well known functions or constructions have not been described so as not to obscure the present invention.

It is to be noted that the present invention is applicable to a digital mobile communication terminal with an SMS function. A Cellular Paging Teleservice (CPT) function mentioned below, corresponding to a PCS Paging Teleservice (PPT) function of the PCS terminal, is an SMS function of a CDMA terminal for transmitting the telephone numbers of the called party and the calling party. A Cellular Message Teleservice (CMT) function corresponding to a PCS message Teleservice (PMT) function of the PCS terminal is an SMS function of the CDMA terminal for transmitting a short user message. These SMS functions are specified in detail in the IS-637 and IS-95A Standards. Thus, the description thereof will be omitted herein.

FIG. **1** shows a block diagram of a digital mobile communication terminal which is suitable for use with the present invention. Referring to FIG. **1**, a controller **10** controls the overall operation of the communication terminal. A memory **11** consists of a ROM (Read Only Memory) for storing an operation program according to the present invention, a RAM (Random Access Memory) for temporarily storing data generated during execution of the operation program and an EEPROM (Electrically Erasable and Programmable ROM) for storing the user predefined messages according to the present invention. An RF (Radio Frequency) module **15** demodulates an RF signal received from an antenna **14** and outputs the modulated RF signal to an encoder/decoder **16**. Further, the RF module **15** modulates a signal input from the encoder/decoder **16**, converts the modulated signal to an RF signal and radiates the RF signal through the antenna **14**.

The encoder/decoder **16**, which is generally a chip specifically designed for use in a CDMA or PCS terminal, encodes the signal generated by the CDMA or PCS terminal under the control of the controller **10** and outputs the encoded signal to the RF module **15**. In addition, the encoder/decoder **16** decodes the signal input from the RF module **15** by the CDMA or PCS terminal and outputs the decoded signal to the controller **10**. A keypad **12**, is a user interface which includes a number of numeric keys for dialing and function keys for performing various functions. The keypad **12** generates key data to the controller **10** upon key manipulation by the user. A display **13**, preferably an LCD (Liquid Crystal Display), displays display data under the control of the controller **10**.

FIGS. **2A** and **2B** are flow charts illustrating the procedure of transmitting a short message in a digital mobile communication terminal according to an embodiment of the present invention. As illustrated, the procedure includes the steps of storing user predefined messages, reading and editing the stored user predefined message, and transmitting the edited message.

Referring to FIGS. **1** to **2B**, the preferred embodiment of the present invention will be described in detail hereinafter. First, to store the user predefined messages, the user will manipulate a message key on keypad **12** which is designated for entering the SMS mode. The controller **10** detects the message key input in step **20** and displays an SMS menu on the display **13** in step **21**. Here, the SMS menu may include a mode for storing the user predefined messages and a mode

for transmitting the short message (SMS mode). The SMS menu assists the user in choosing the available modes. With guidance from the SMS menu, the user will manipulate a mode select key for selecting the mode for storing the user predefined message.

When the user predefined message storing mode is selected in step **22**, the controller **10** displays first display data on the display **13** in step **23**. The first display data may be data notifying the user to input the user predefined message that he desires to store. After reviewing the first display data, the user will input the user predefined message by manipulating the character keys of keypad **12**. The controller **10** then receives the desired user predefined message (step **24**) until a signal representing completion of the message input is entered by the user in step **25**. Here, the signal representing the completion of the message input may be generated by depression of a specified key. Thereafter, if a storage address is input in step **26**, the controller **10** stores the user predefined message in the storage address in step **27**.

If in step **22** the user does not choose the message storage mode but chooses the SMS transmission mode, the controller **10** senses that the SMS transmission mode is selected (step **28**) and displays second display data on the display **13** in step **29**. Here, the second display data may be data notifying the user to choose between the CMT function and the CPT function. Then, the user will choose one of the CMT and CPT functions by manipulating the keys in response to the second display data. If the user chooses the CMT function in step **30**, the controller **10** displays third display data on the display **13** in step **31**. Here, the third display data may be data notifying the user to decide whether to use the user predefined message or not in inputting the short message to be transmitted. If the user decides to use a user predefined message in step **32**, the controller **10** displays a menu consisting of the user predefined messages on the display **13** in step **33**. The user then manipulates a select key to choose one of the user predefined messages which is the most similar to the short message that he desires to transmit. Upon sensing the selection of the user predefined message in step **34**, the controller **10** displays the selected user predefined message on the display **13** in step **35**.

After the selected user predefined message is displayed, the user will edit, if necessary, the user predefined message through key manipulation in step **36**. However, if in step **32** the user decides not to use the user predefined message but input a new message by himself, the controller **10** receives the message that the user inputs by manipulating the keys and displays the input message on the display **13** in step **43**. On receiving a signal representing completion of the message edit or the message input in step **37**, the controller **10** displays fourth display data on the display **13** in step **38**. Here, the fourth display data may be the edited message or new input message as well as data prompting the user to input the telephone numbers for the called party and the calling party. In compliance with the fourth display data, the user will input the telephone numbers for the called party and the calling party and then activate a send key, i.e. generate a message transmission command, for transmitting the short message.

The controller **10** receives the telephone number for the called party to which the short message is to be transmitted in step **39** and the telephone number for the calling party in step **40**, and transmits the short message to the called party upon receipt of the send key input in step **41**. However, if the user inputs the telephone numbers without editing the message in step **36**, the controller **10** jumps to step **39**. In addition, if the user does not choose the CMT function in step **30** but instead chooses the CPT function in step **44**, the controller **10** also jumps to step **39**. According to another embodiment of the present invention, the message input in step **43** may be also stored as another user predefined message.

As described above, the digital mobile communication terminal of the present invention stores user predefined messages that the user frequently uses and transmits the short message by choosing and editing one of the stored user predefined messages which is closest to the message to be transmitted. Accordingly, the user can input short messages easily and save time in generating a suitable generating a short message.

While the present invention has been described in detail with reference to the specific embodiment of the present invention, it is a mere exemplary application. Thus, it is to be clearly understood that many variations can be made by anyone skilled in the art within the scope and spirit of the present invention.

What is claimed is:

1. A method for transmitting a short message in a digital mobile communication terminal having a memory in which user predefined messages are stored in specified addresses, comprising the steps of:

determining whether a short message transmission mode is set through user interface means;

determining whether a user predefined message using mode is set, upon sensing that the short message transmission mode is set;

upon receiving a signal representing a mode for storing the user predefined message, displaying first display data notifying a user to input said user predefined message;

storing in said memory the user predefined message that the user inputs in reply to said first display data;

reading the user predefined messages from said memory and displaying the read user predefined messages, upon sensing that the user predefined message using mode is set;

displaying one of said user predefined messages selected through said user interface means;

displaying second display data notifying the user to select one of said user predefined messages stored in said memory; and

reading the user predefined message selected by the user and editing the read user predefined message to a short message to be transmitted

determining whether a telephone number for a called party is input through the user interface means;

determining whether a message transmission command is input through the user interface means; and

upon receipt of said message transmission command, transmitting said edited message to the telephone number for the called party.

2. The method as claimed in claim **1**, wherein after said displaying step, the method comprises the further step of editing said selected user predefined message according to edit data or input data received from said user interface means.

3. The method as claimed in claim **2**, wherein said method further comprises the step of:

determining whether a telephone number for a calling party is input through the user interface means, when the telephone number for the called party is input.

4. A method for transmitting a short message in a digital mobile communication terminal having a memory, comprising the steps of:

upon receiving a signal representing a mode for storing the user predefined message, displaying first display data notifying a user to input said user predefined message;

storing in said memory the user predefined message that the user inputs in reply to said first display data;

reading one of said user predefined messages from said memory;

editing said read user predefined message, comprising the steps of:

displaying second display data notifying the user to select one of said user predefined messages stored in said memory; and

reading the user predefined message selected by the user and editing the read user predefined message to a short message to be transmitted;

entering a telephone number for a called party;

entering a message transmission command; and

transmitting said edited message.

5. A digital mobile communication terminal for transmitting a short message comprising:

upon receiving a signal representing a mode for storing the user predefined message, displaying first display data notifying a user to input said user predefined message;

means for storing in a memory the user predefined message that the user inputs in reply to said first display data;

means for accessing said stored predefined messages;

means for editing said accessed predefined message, comprising:

means for displaying second display data notifying the user to select one of said user predefined messages stored in said memory; and

means for reading the user predefined message selected by the user and editing the read user predefined message to a short message to be transmitted;

means for entering a telephone number for a called party;

means for entering a message transmission command; and

means for transmitting said edited message.

6. A digital mobile communication terminal as claimed in claim 5, further comprising means for displaying said predefined messages.

7. A digital mobile communication terminal as claimed in claim 6, wherein said means for storing includes memory operatively coupled to a controller.

8. A digital mobile communication terminal as claimed in claim 7, wherein said means for editing includes a keypad having a plurality of keys and being operatively coupled to said controller.

9. A digital mobile communication terminal as claimed in claim 8, wherein said means for displaying includes a liquid crystal display operatively coupled to said controller.

* * * * *

US005249220A

United States Patent [19]

Moskowitz et al.

[11] Patent Number: 5,249,220

[45] Date of Patent: Sep. 28, 1993

[54] **HANDHELD FACSIMILE AND ALPHANUMERIC MESSAGE TRANSCEIVER OPERATING OVER TELEPHONE OR WIRELESS NETWORKS**

[75] Inventors: **Jay Moskowitz**, Hicksville; **Abraham Karron**, Long Beach; **Peter Squillante**, Central Islip; **Spencer Kravitz**, Hicksville, all of N.Y.

[73] Assignee: **RTS Electronics, Inc.**, Hicksville, N.Y.

[21] Appl. No.: **687,380**

[22] Filed: **Apr. 18, 1991**

[51] **Int. Cl.**[5] **H04M 11/00**; H03M 7/40; H04L 27/10

[52] **U.S. Cl.** **379/93**; 379/96; 379/97; 379/100; 341/106; 341/65; 341/67; 375/56

[58] **Field of Search** 379/100, 93, 96, 97, 379/98, 52; 358/470, 427, 261.4; 341/106, 65, 90, 67; 178/18; 375/67, 56

[56] **References Cited**

U.S. PATENT DOCUMENTS

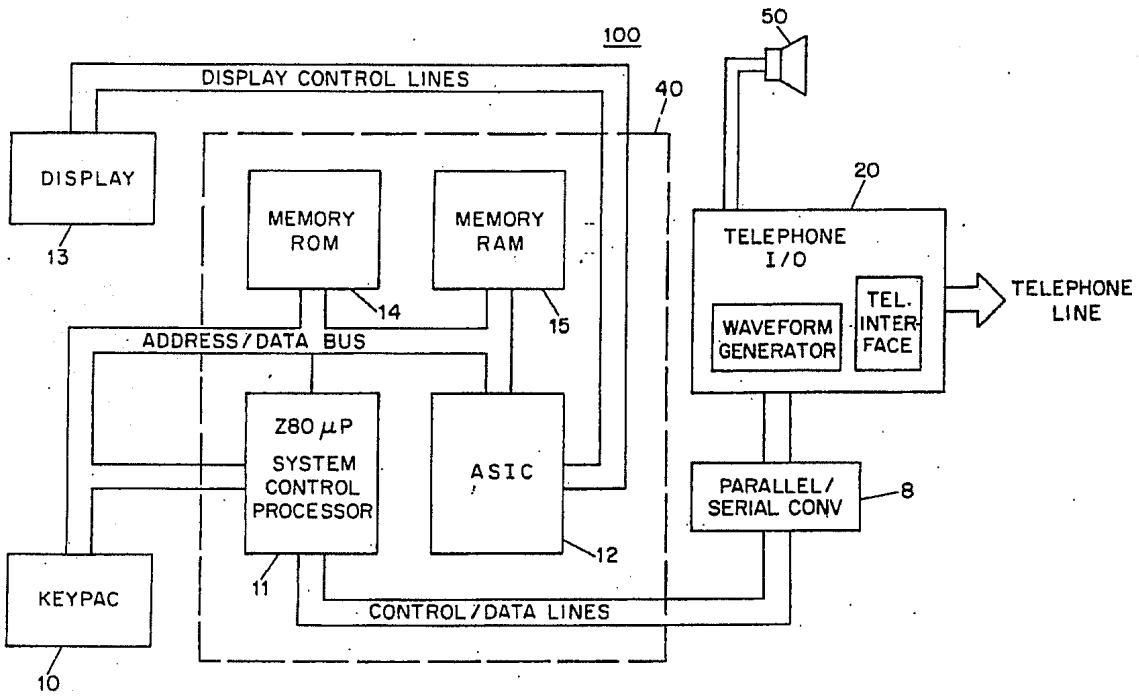
4,394,649	7/1983	Suchoff et al. .	
4,440,977	4/1984	Pao et al.	379/97
4,514,825	4/1985	Nordling	379/98
4,620,294	10/1986	Leung et al.	379/98
4,794,634	12/1988	Torihata et al.	178/18
4,799,254	1/1989	Dayton et al.	379/97
4,805,208	2/1989	Schwartz	379/93
4,809,081	2/1989	Linehan	341/51
4,837,812	6/1989	Takahashi et al.	379/100
4,918,723	4/1990	Iggulden et al. .	
5,055,841	10/1991	Cordell	341/67

Primary Examiner—James L. Dwyer
Assistant Examiner—Jason Chan
Attorney, Agent, or Firm—Brumbaugh, Graves, Donohue & Raymond

[57] **ABSTRACT**

According to the present invention, a hand-held portable transmitter is provided which is capable of communicating with a variety of different message receiving hosts. The transmitter is provided with a technique for generating waveforms to communicate with foreign message receivers over a communication channel by using a lookup table and software implementation in combination with a telephone interface circuit. Also provided is a versatile encoding protocol in which a message is optionally converted to a four-bit, five-bit, or six-bit sequence, or to a sequence of variable-length bit-strings, the converted message is queued and regrouped as four-bit nibbles, and the nibbles are communicated by DTMF tones.

58 Claims, 25 Drawing Sheets



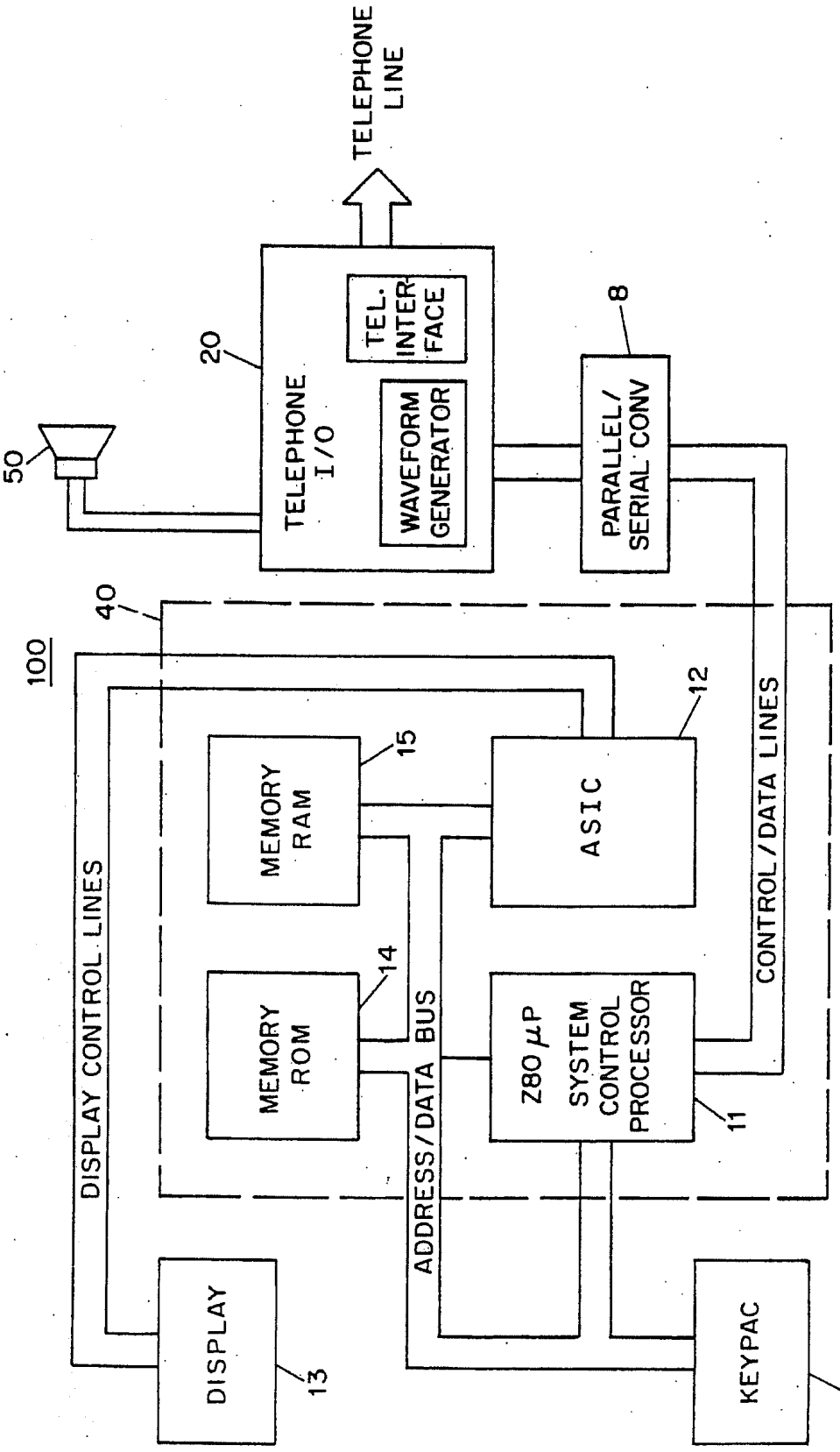

TELEPHONE LINE
20
TEL. INTER FACE
TELEPHONE I/O
WAVEFORM GENERATOR
8
PARALLEL/ SERIAL CONV
50
40
100
12
15
MEMORY RAM
ASIC
CONTROL/DATA LINES
DISPLAY CONTROL LINES
14
MEMORY ROM
Z80 μP SYSTEM CONTROL PROCESSOR
11
ADDRESS/DATA BUS
DISPLAY
13
KEYPAC
10

FIG. 1

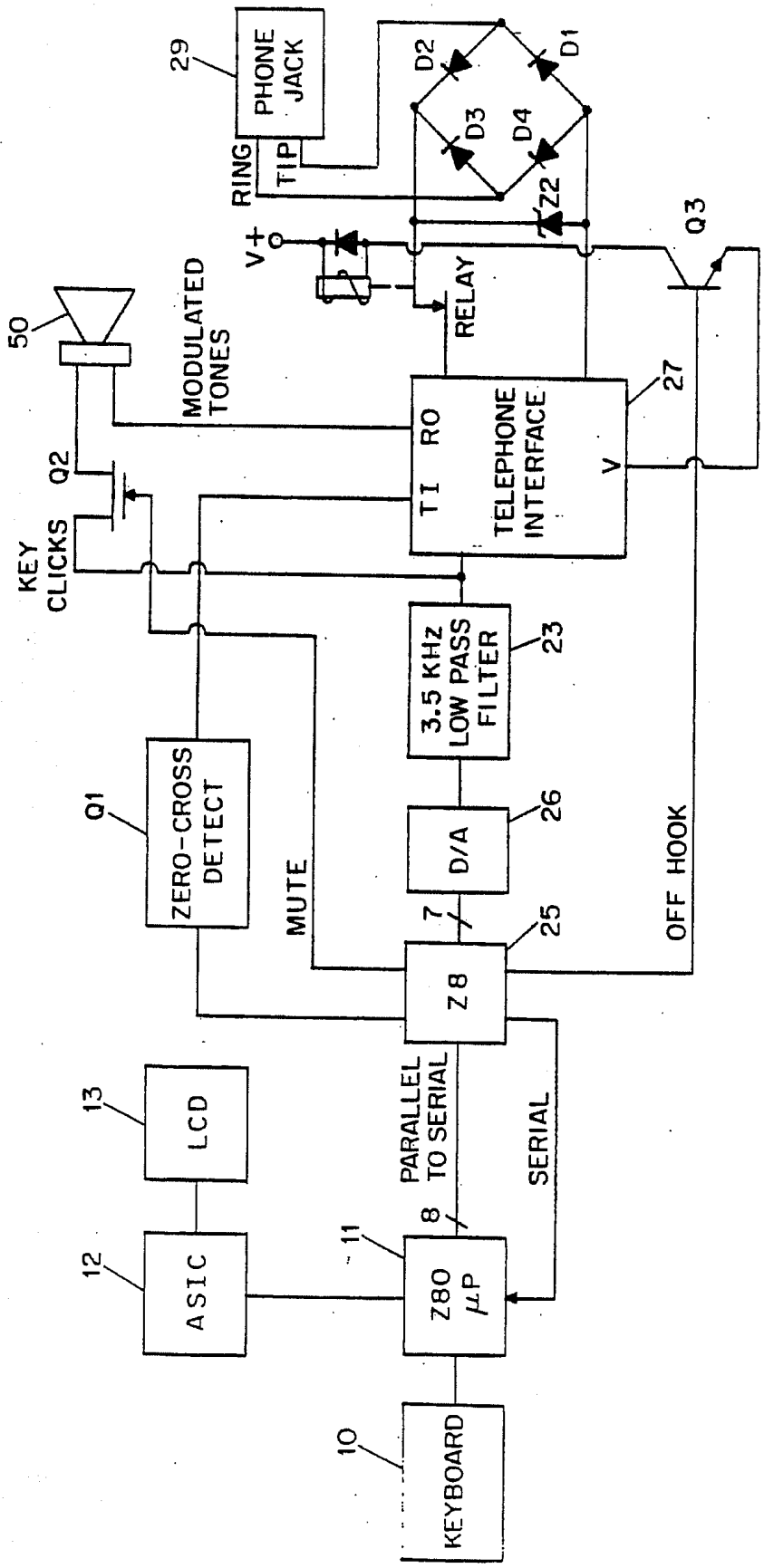

29
PHONE JACK
RING
TIP
D1
D2
D3
D4
Z2
Q3
V+
RELAY
50
MODULATED TONES
Q2
KEY CLICKS
TELEPHONE INTERFACE
RO
TI
V
27
3.5 KHz LOW PASS FILTER
23
Q1
ZERO-CROSS DETECT
MUTE
D/A
26
7
25
OFF HOOK
Z8
13
LCD
PARALLEL TO SERIAL
SERIAL
8
11
12
ASIC
Z80 μP
10
KEYBOARD

FIG. 2

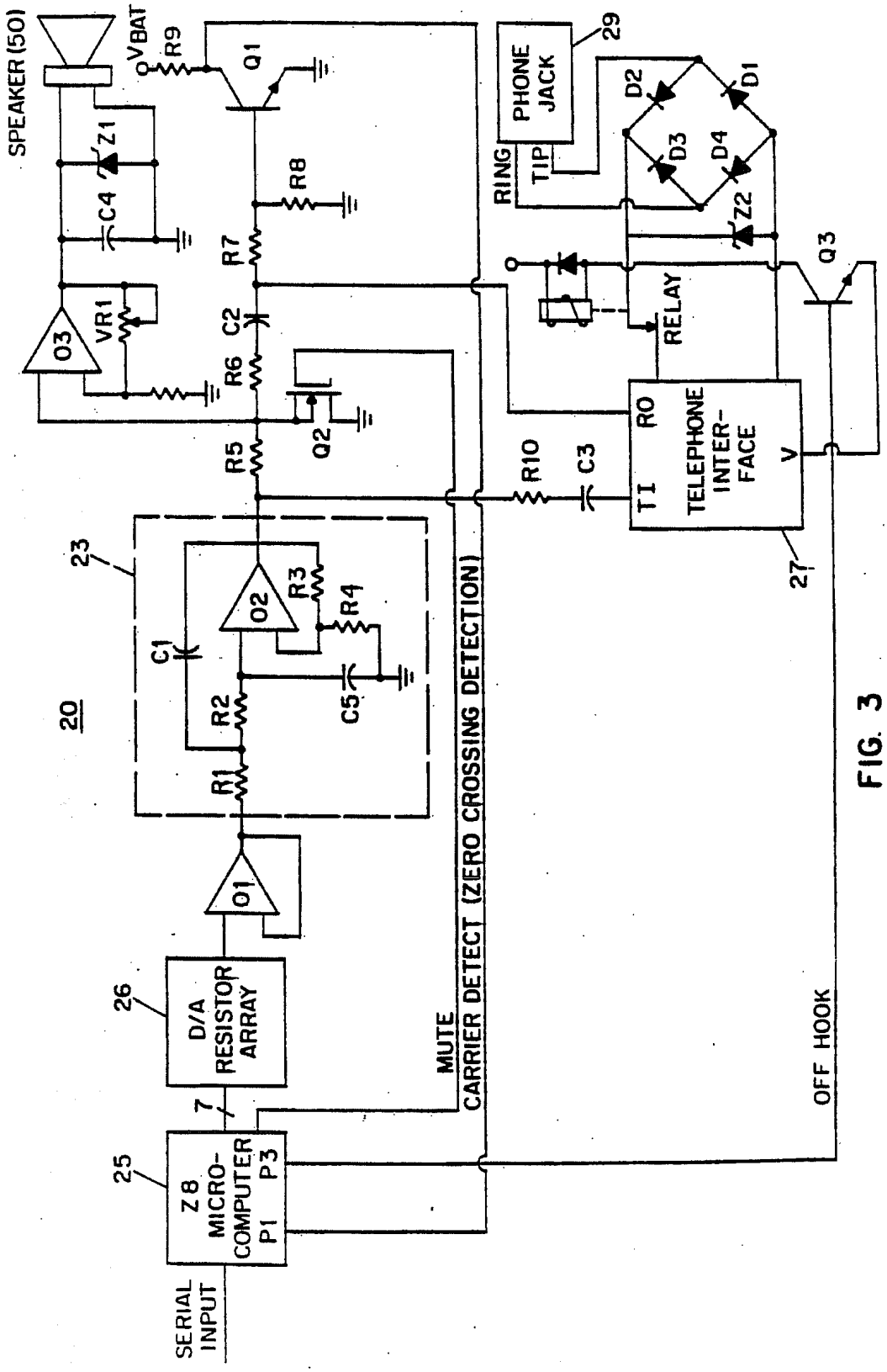

SPEAKER (50)
VBAT
R9
Q1
Z1
C4
R8
R7
VR1
O3
C2
R6
Q2
R5
20
23
O2
R3
R4
C1
C5
R2
R1
O1
26
D/A RESISTOR ARRAY
7
25
Z8 MICRO-COMPUTER P1 P3
SERIAL INPUT
MUTE
CARRIER DETECT (ZERO CROSSING DETECTION)
PHONE JACK
29
RING
TIP
D2
D1
D3
D4
Z2
Q3
RELAY
R10
C3
RO
TI
TELEPHONE INTER-FACE
V
27
OFF HOOK

FIG. 3

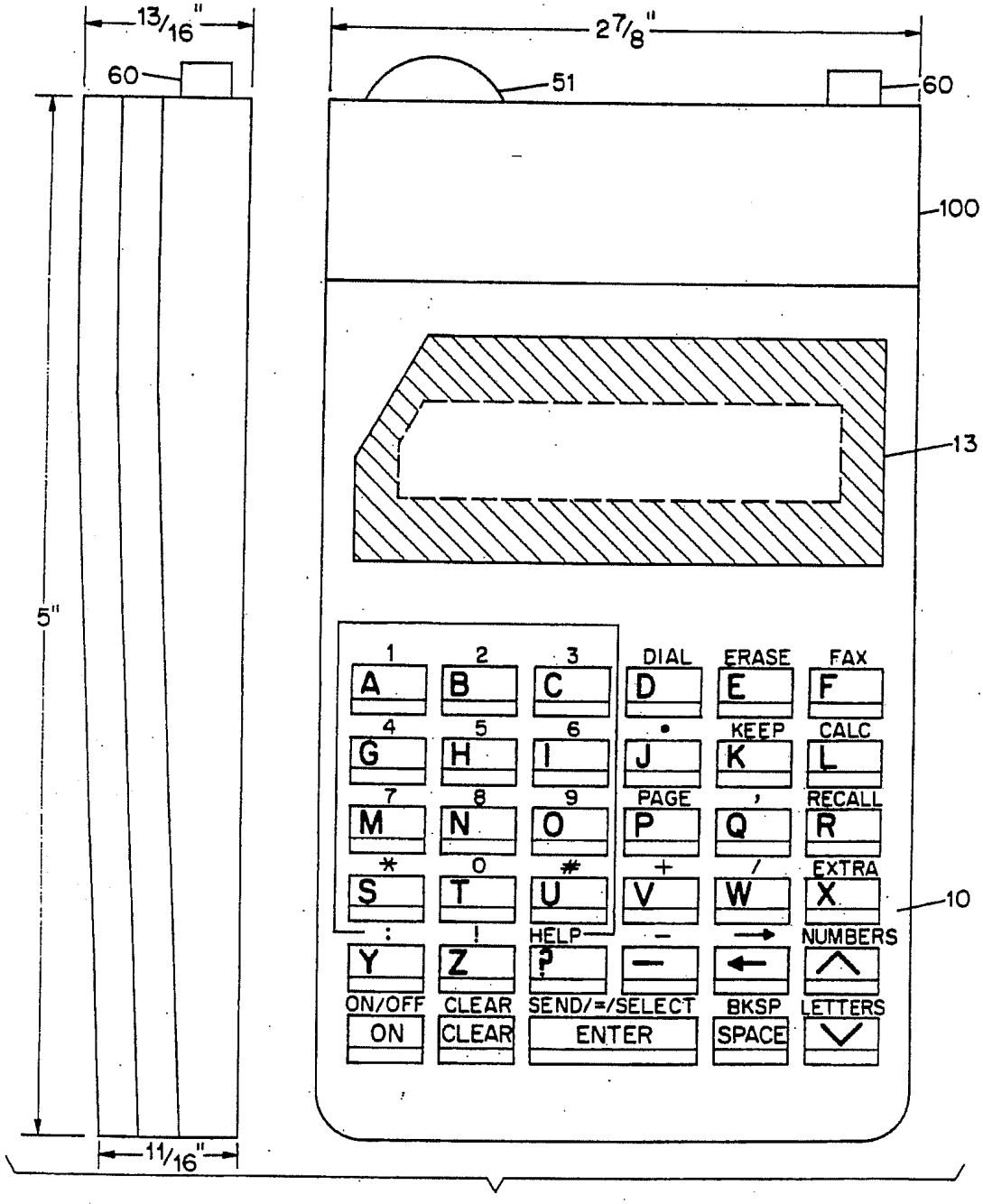

13/16"
60
5"
11/16"
27/8"
51
60
100
13
1
2
3
DIAL
ERASE
FAX
A
B
C
D
E
F
4
5
6
KEEP
CALC
G
H
I
J
K
L
7
8
9
PAGE
RECALL
M
N
O
P
Q
R
*
0
#
+
/
EXTRA
S
T
U
V
W
X
10
:
!
HELP
NUMBERS
Y
Z
?
ON/OFF
CLEAR
SEND/=/SELECT
BKSP
LETTERS
ON
CLEAR
ENTER
SPACE

FIG. 4

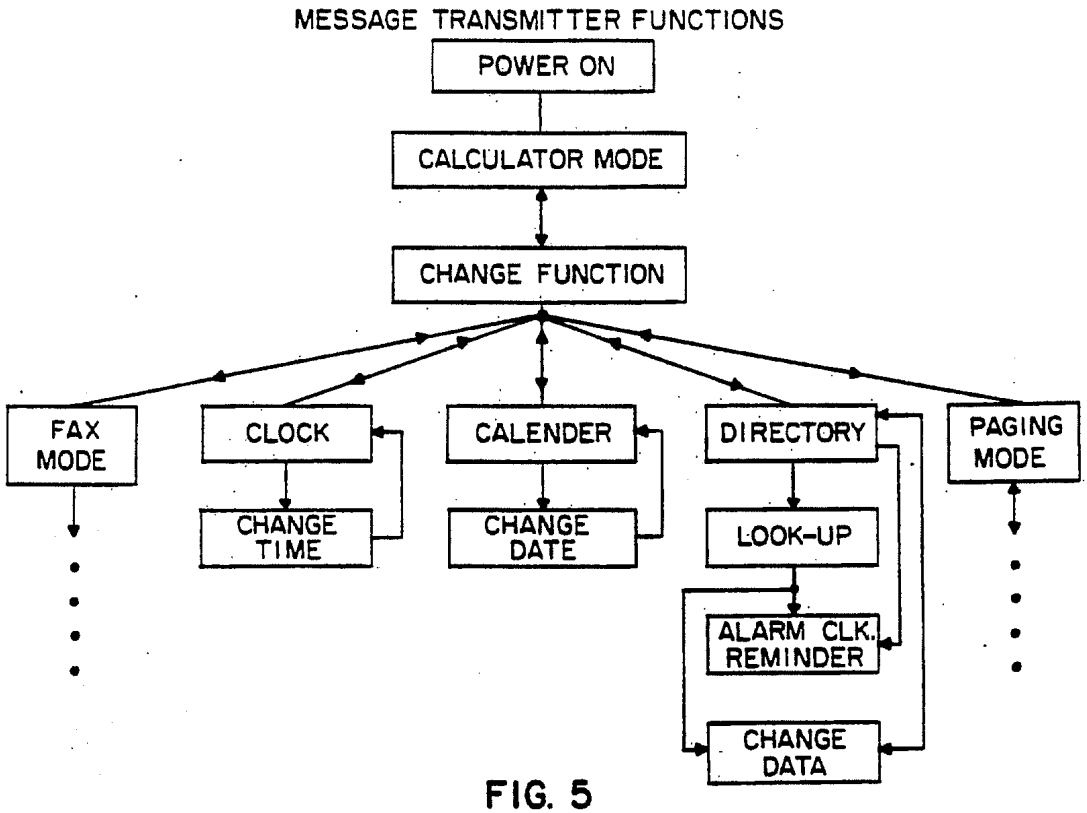


FIG. 5

TONE	FOUR BIT ENCODING CHARACTER	
0	0	
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7	7	
8	8	
9	9	
A	(	
B	)	
C	" "	(SPACE CHARACTER)
D	-	(HYPHEN)
E	.	(PERIOD)
F	EOT	(SPECIAL END OF TRANSMISSION CHARACTER)

FIG. 6

FIVE BIT ENCODING

BINARY CODE	HEX	GROUP 1 UC	GROUP 1 LC	GROUP 2 UC	GROUP 2 LC
0 0000	0	A	a	0	'
0 0001	1	B	b	1	;
0 0010	2	C	c	2	<
0 0011	3	D	d	3	>
0 0100	4	E	e	4	[
0 0101	5	F	f	5	\
0 0110	6	G	g	6	]
0 0111	7	H	h	7	^
0 1000	8	I	i	8	_
0 1001	9	J	j	9	`
0 1010	A	K	k	:	{
0 1011	B	L	l	=	|
0 1100	C	M	m	?	}
0 1101	D	N	n	!	~
0 1110	E	O	o	"	RESERVED
0 1111	F	P	p	#	RESERVED
1 0000	10	Q	q	$	RESERVED
1 0001	11	R	r	%	RESERVED
1 0010	12	S	s	&	RESERVED
1 0011	13	T	t	(	RESERVED
1 0100	14	U	u	)	RESERVED
1 0101	15	V	v	*	RESERVED
1 0110	16	W	w	+	RESERVED
1 0111	17	X	x	-	RESERVED
1 1000	18	Y	y	/	RESERVED
1 1001	19	Z	z	@	RESERVED
1 1010	1A	..... SPACE " "			
1 1011	1B	..... COMMA " , "			
1 1100	1C	..... PERIOD " . "			
1 1101	1D	... SWITCH TO OTHER GROUP			
1 1110	1E	.SWITCH CASE WITHIN THIS GROUP			
1 1111	1F	EOT (END OF TRANSMISSION CHARACTER)			

FIG. 7

SIX BIT ENCODING

BINARY CODE	HEX	GROUP 1 UC / LC		GROUP 2 UC / LC	
00 0000	0	<SPACE>	<SPACE>	[	[
00 0001	1	!	!	\	\
00 0010	2	"	"	]	]
00 0011	3	#	#	^	^
00 0100	4	$	$	_	_
00 0101	5	%	%	{	{
00 0110	6	&	&	|	|
00 0111	7	'	'	}	}
00 1000	8	(	(	~	~
00 1001	9	)	)		
00 1010	A	*	*		
00 1011	B	+	+	< ALL OTHER CODES	
00 1100	C	,	,	ARE RESERVED IN	
00 1101	D	-	-	GROUP 2 >	
00 1110	E	.	.		
00 1111	F	/	/		
01 0000	10	0	0		
01 0001	11	1	1		
01 0010	12	2	2		
01 0011	13	3	3		
01 0100	14	4	4		
01 0101	15	5	5		
01 0110	16	6	6		
01 0111	17	7	7		
01 1000	18	8	8		
01 1001	19	9	9		
01 1011	1A	:	:		
01 1010	1B	;	;		
01 1100	1C	<	<		
01 1101	1D	=	=		
01 1110	1E	>	>		
01 1111	1F	?	?		

FIG. 8(a)

SIX BIT ENCODING (CONT'D)

BINARY CODE	HEX	GROUP 1 UC / LC	GROUP 2 UC / LC
10 0000	20	@ `	
10 0001	21	A a	
10 0010	22	B b	
10 0011	23	C c	
10 0100	24	D d	
10 0101	25	E e	
10 0110	26	F f	
10 0111	27	G g	< THESE GROUP 2
10 1000	28	H h	CODES ARE
10 1001	29	I i	RESERVED >
10 1000	2A	J j	
10 1011	2B	K k	
10 1100	2C	L l	
10 1101	2D	M m	
10 1110	2E	N n	
10 1111	2F	O o	
11 0000	30	P p	
11 0001	31	Q q	
11 0010	32	R r	
11 0011	33	S s	
11 0100	34	T t	
11 0101	35	U u	
11 0110	36	V v	
11 0111	37	W w	
11 1000	38	X x	
11 1001	39	Y y	
11 1010	3A	Z z	
11 1011	3B	RESERVED	
11 1100	3C	RESERVED	
11 1101	3D	SWITCH TO OTHER GROUP	
11 1110	3E	SWITCH TO OTHER CASE	
11 1111	3F	EOT (END OF TRANSMISSION)	

FIG. 8(b)

HUFFMAN ENCODING TABLE–AMERICAN ENGLISH
TABLE ORDERED BY CHARACTER CODE IN ASCII

CHARACTER	HUFFMAN CODE	
CHANGE CASE	1100 1001	
<SPACE>	111	
EOT	0001 1	{END OF TRANSMISSION}
!	0010 1010 01	
"	1100 1000 1001 10	
#	0010 1000 00	
$	1100 1000 1001 00	
%	1100 1000 1001 0111 1	
&	0010 1000 1111	
'	1100 1000 0	
(	0010 1000 1110	
)	1100 1000 1011 1	
*	1100 1000 1000	
+	1100 1000 1001 0110 1	
,	0010 1010 1	
–	0010 0	
.	0100 00	
/	1100 1010	
0	1001 11	
1	1101 11	
2	1100 11	
3	0101 11	
4	0110 10	
5	0101 10	
6	0100 11	
7	0010 11	
8	1000 01	
9	0100 01	
:	1000 001	
;	1100 1000 1001 11	
<	1100 1000 1001 0100 1	
=	1001 10	
>	1100 1000 1001 0111 0	
?	0010 1000 10	
@	1100 1000 1001 0101	

FIG. 9(a)

CHARACTER	HUFFMAN CODE
A	0111
B	1000 111
C	0101 0
D	0110 11
E	1010
F	0001 01
G	0001 00
H	1100 01
I	1011 1
J	0010 1011
K	1000 000
L	0011
M	1101 10
N	1001 0
O	1101 0
P	1000 10
Q	0010 1000 110
R	1011 0
S	0110 0
T	0000
U	1100 00
V	1100 1011
W	1000 110
X	1100 1000 11
Y	0100 10
Z	0010 1010 00
[	1100 1000 1010
\	0010 1000 01
]	1100 1000 1011 0
^	1100 1000 1001 0100 0110
_	0010 1001
`	1100 1000 1001 0110 0
{	1100 1000 1001 0100 0111
|	1100 1000 1001 0100 010
}	1100 1000 1001 0100 001
~	1100 1000 1001 0100 000

FIG. 9(b)

HUFFMAN ENCODING TABLE-AMERICAN ENGLISH
TABLE ORDERED BY HUFFMAN CODE LENGTH

CHARACTER	HUFFMAN CODE	
<SPACE>	111	
A	0111	
E	1010	
L	0011	
T	0000	
C	0101 0	
I	1011 1	
N	1001 0	
O	1101 0	(LETTER O)
R	1011 0	
S	0110 0	
-	0010 0	(HYPHEN)
EOT	0001 1	(END OF TRANSMISSION)
D	0110 11	
F	0001 01	
G	0001 00	
H	1100 01	
M	1101 10	
P	1000 10	
U	1100 00	
Y	0100 10	
0	1001 11	(NUMBER 0)
1	1101 11	
2	1100 11	
3	0101 11	
4	0110 10	
5	0101 10	
6	0100 11	
7	0010 11	
8	1000 01	
9	0100 01	
.	0100 00	(PERIOD)
=	1001 10	
B	1000 111	
K	1000 000	
W	1000 110	
:	1000 001	(COLON)

FIG. 9(c)

CHARACTER	HUFFMAN CODE	
J	0010 1011	
V	1100 1011	
CHANGE CASE	1100 1001	
/	1100 1010	(SLASH)
_	0010 1001	(UNDERSCORE)
'	1100 1000 0	(APOSTROPHE/ASCII 27 HEX)
,	0010 1010 1	(COMMA)
X	1100 1000 11	
Z	0010 1010 00	
!	0010 1010 01	
?	0010 1000 10	
\	0010 1000 01	(BACK SLASH)
#	0010 1000 00	(POUND/NUMBER SIGN)
Q	0010 1000 110	
[	1100 1000 1010	
*	1100 1000 1000	
&	0010 1000 1111	
(	0010 1000 1110	
)	1100 1000 1011 1	
]	1100 1000 1011 0	
;	1100 1000 1001 11	(SEMI-COLON)
"	1100 1000 1001 10	
$	1100 1000 1001 00	
@	1100 1000 1001 0101	
%	1100 1000 1001 0111 1	
>	1100 1000 1001 0111 0	
+	1100 1000 1001 0110 1	
`	1100 1000 1001 0110 0	(ASCII 60 HEX)
<	1100 1000 1001 0100 1	
|	1100 1000 1001 0100 010	(VERTICAL BAR)
}	1100 1000 1001 0100 001	
~	1100 1000 1001 0100 000	(TILDE)
{	1100 1000 1001 0100 0111	
^	1100 1000 1001 0100 0110	(UP ARROW)

FIG. 9(d)

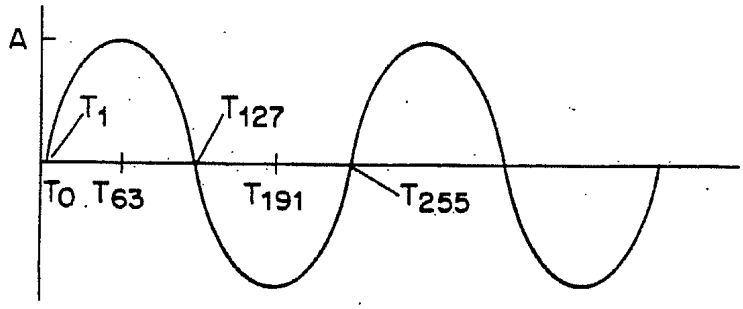


FIG. 10

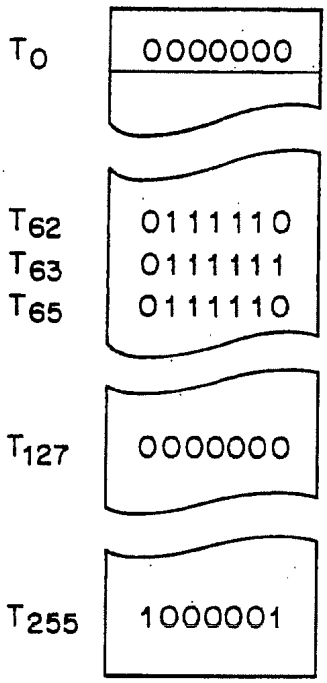


FIG. 11

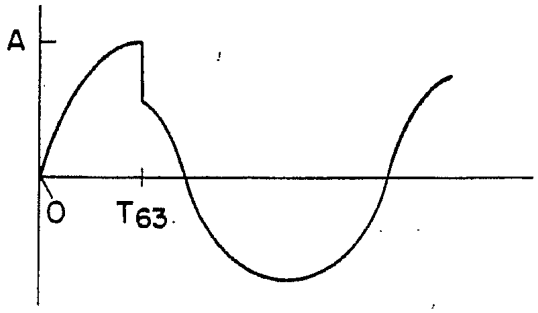


FIG. 12

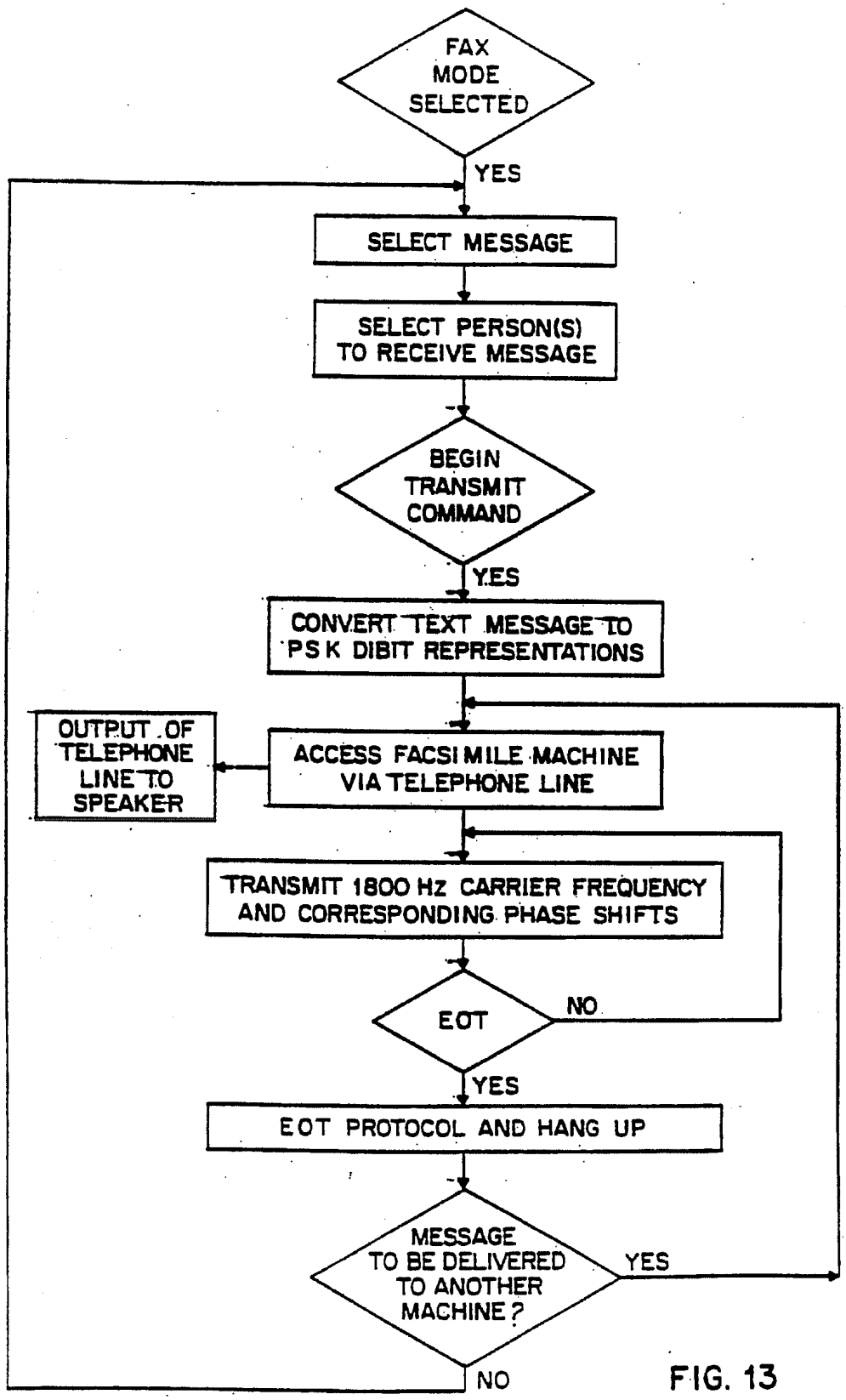
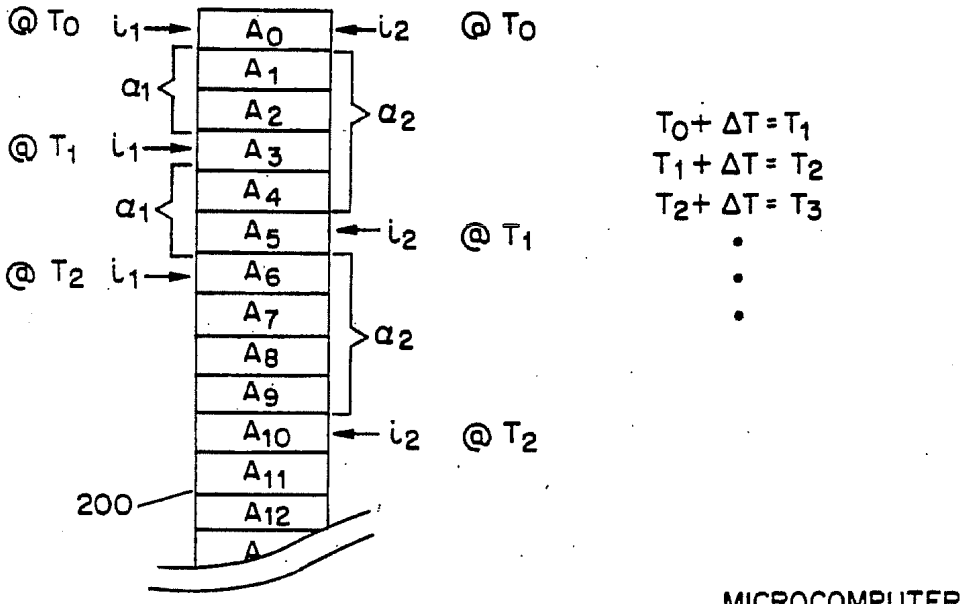

FAX MODE SELECTED
YES
SELECT MESSAGE
SELECT PERSON(S) TO RECEIVE MESSAGE
BEGIN TRANSMIT COMMAND
YES
CONVERT TEXT MESSAGE TO PSK DIBIT REPRESENTATIONS
OUTPUT OF TELEPHONE LINE TO SPEAKER
ACCESS FACSIMILE MACHINE VIA TELEPHONE LINE
TRANSMIT 1800 Hz CARRIER FREQUENCY AND CORRESPONDING PHASE SHIFTS
EOT
NO
YES
EOT PROTOCOL AND HANG UP
MESSAGE TO BE DELIVERED TO ANOTHER MACHINE?
YES
NO

FIG. 13

DTMF CONVERSION TABLE

BINARY NIBBLE	DTMF DIGIT	HEX REPR.	HIGH FREQUENCY (HZ)	LOW FREQUENCY (HZ)
0000	0	0	1336	941
0001	1	1	1209	697
0010	2	2	1336	697
0011	3	3	1477	697
0100	4	4	1209	770
0101	5	5	1336	770
0110	6	6	1477	770
0111	7	7	1209	852
1000	8	8	1336	852
1001	9	9	1477	852
1010	A	A	1633	697
1011	B	B	1633	770
1100	C	C	1633	852
1101	D	D	1633	941
1110	*	E	1209	941
1111	#	F	1477	941

FIG. 14



TIME		INDEX VALUE		MICROCOMPUTER OUTPUT
T_0	→	$i_1T_0 + i_2T_0$	=	2A
T_1	→	$i_1T_1 + i_2T_1$	=	$(A_3 + A_5)$
T_2	→	$i_1T_2 + i_2T_2$	=	$(A_6 + A_{10})$
T_3	→	$i_2T_3 + i_3T_3$	=	• • •

FIG. 15

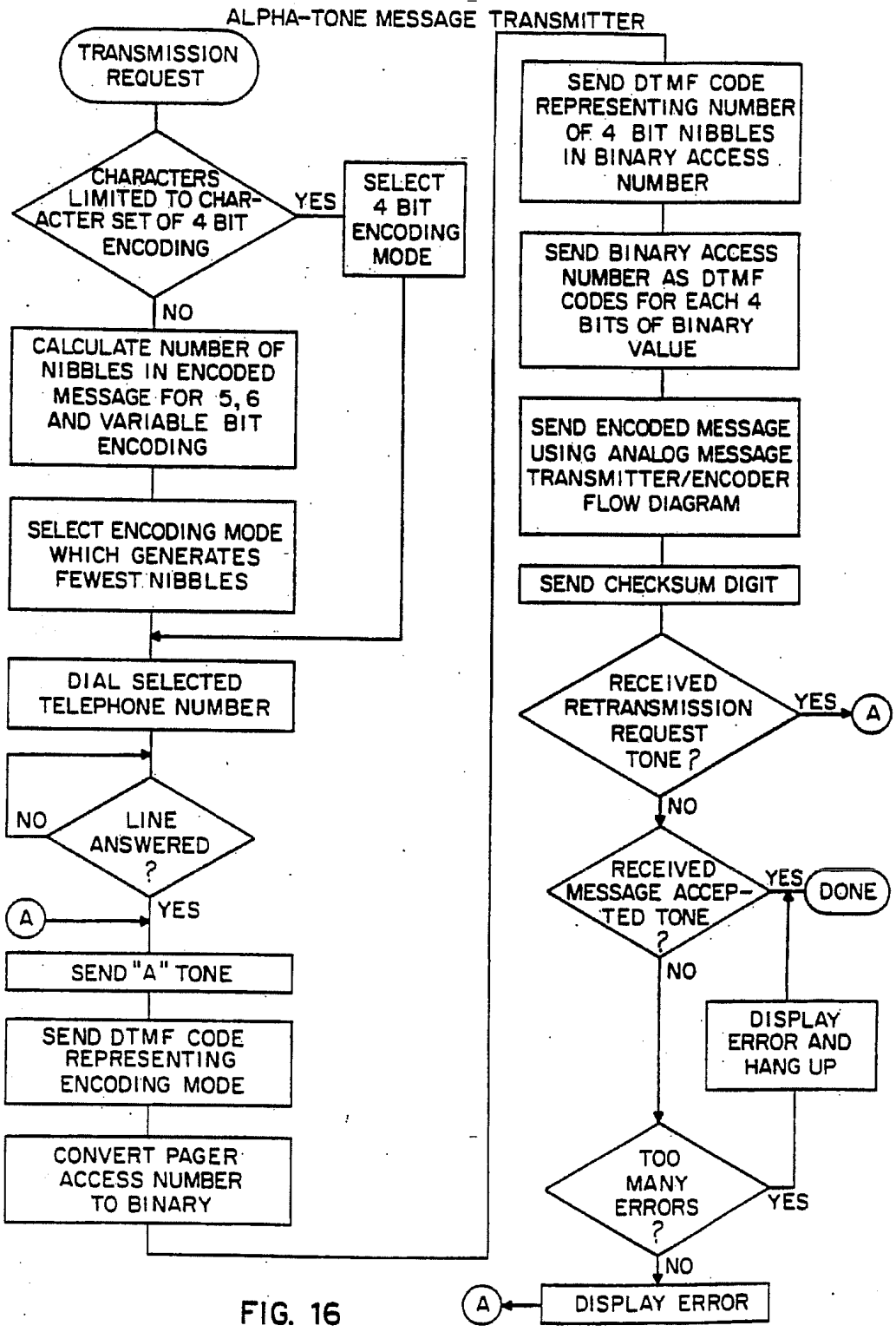

ALPHA-TONE MESSAGE TRANSMITTER
TRANSMISSION REQUEST
CHARACTERS LIMITED TO CHARACTER SET OF 4 BIT ENCODING
YES
SELECT 4 BIT ENCODING MODE
NO
CALCULATE NUMBER OF NIBBLES IN ENCODED MESSAGE FOR 5, 6 AND VARIABLE BIT ENCODING
SELECT ENCODING MODE WHICH GENERATES FEWEST NIBBLES
DIAL SELECTED TELEPHONE NUMBER
NO
LINE ANSWERED ?
YES
A
SEND "A" TONE
SEND DTMF CODE REPRESENTING ENCODING MODE
CONVERT PAGER ACCESS NUMBER TO BINARY
SEND DTMF CODE REPRESENTING NUMBER OF 4 BIT NIBBLES IN BINARY ACCESS NUMBER
SEND BINARY ACCESS NUMBER AS DTMF CODES FOR EACH 4 BITS OF BINARY VALUE
SEND ENCODED MESSAGE USING ANALOG MESSAGE TRANSMITTER/ENCODER FLOW DIAGRAM
SEND CHECKSUM DIGIT
RECEIVED RETRANSMISSION REQUEST TONE ?
YES
A
NO
RECEIVED MESSAGE ACCEPTED TONE ?
YES
DONE
NO
DISPLAY ERROR AND HANG UP
TOO MANY ERRORS ?
YES
NO
A
DISPLAY ERROR

FIG. 16

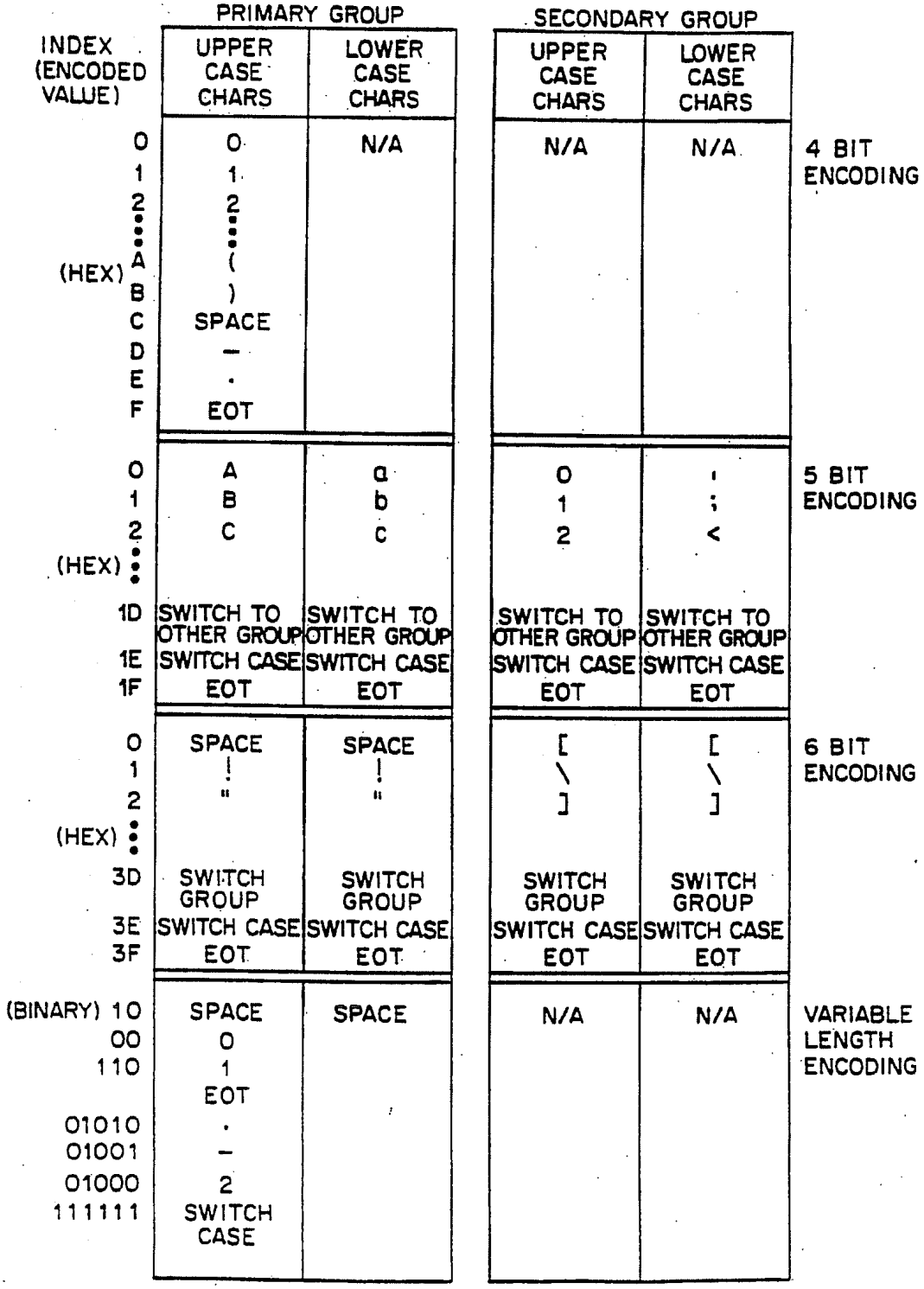

PRIMARY GROUP
SECONDARY GROUP
INDEX (ENCODED VALUE)
UPPER CASE CHARS
LOWER CASE CHARS
UPPER CASE CHARS
LOWER CASE CHARS
0 0 N/A N/A N/A 4 BIT ENCODING
1 1
2 2
(HEX) A (
B)
C SPACE
D –
E .
F EOT
0 A a 0 ' 5 BIT ENCODING
1 B b 1 ;
2 C c 2 <
(HEX)
1D SWITCH TO OTHER GROUP SWITCH TO OTHER GROUP SWITCH TO OTHER GROUP SWITCH TO OTHER GROUP
1E SWITCH CASE SWITCH CASE SWITCH CASE SWITCH CASE
1F EOT EOT EOT EOT
0 SPACE SPACE [[6 BIT ENCODING
1 ! ! \ \
2 " "]]
(HEX)
3D SWITCH GROUP SWITCH GROUP SWITCH GROUP SWITCH GROUP
3E SWITCH CASE SWITCH CASE SWITCH CASE SWITCH CASE
3F EOT EOT EOT EOT
(BINARY) 10 SPACE SPACE N/A N/A VARIABLE LENGTH ENCODING
00 0
110 1
EOT
01010 .
01001 –
01000 2
111111 SWITCH CASE

FIG. 17

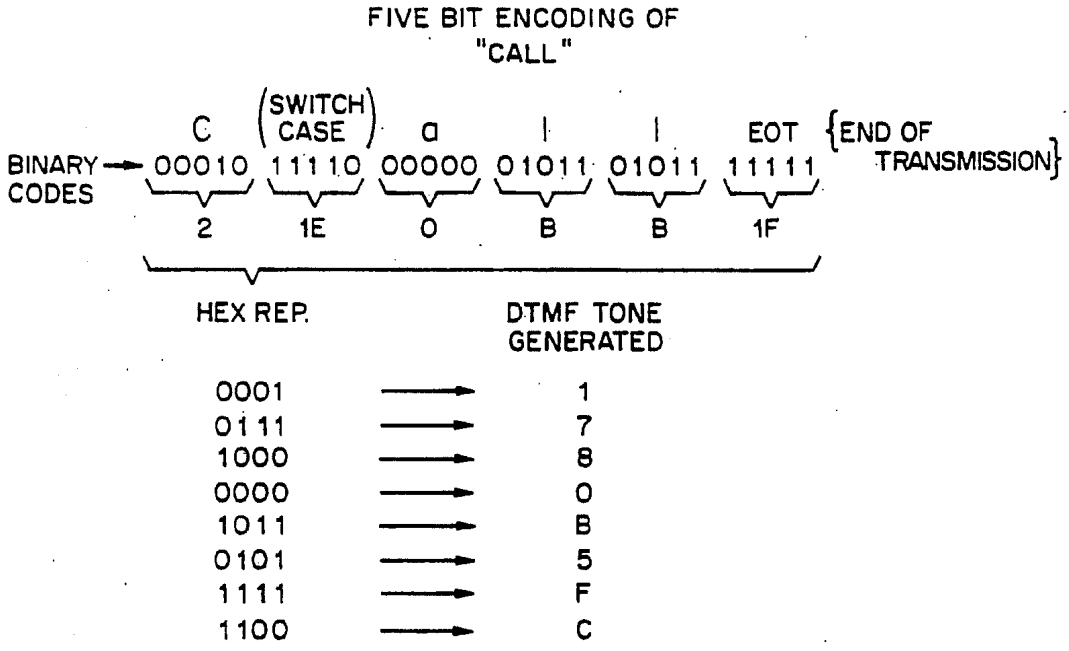
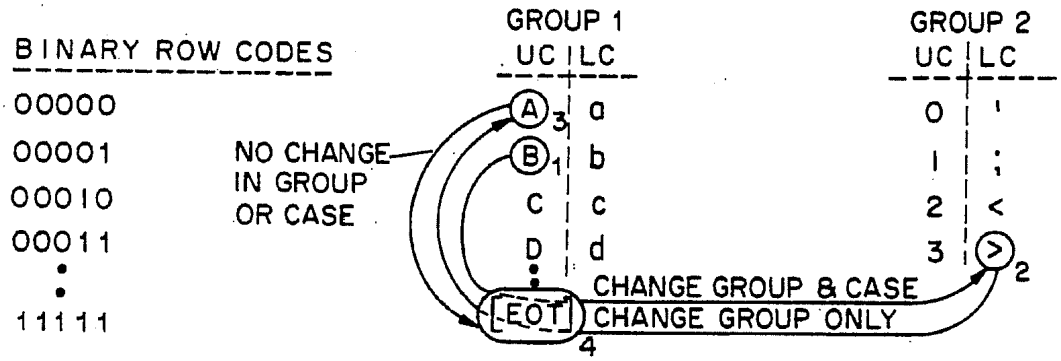

FIVE BIT ENCODING OF "CALL"
C
SWITCH CASE
a
l
l
EOT
END OF TRANSMISSION
BINARY CODES
00010
11110
00000
01011
01011
11111
2
1E
0
B
B
1F
HEX REP.
DTMF TONE GENERATED
0001 → 1
0111 → 7
1000 → 8
0000 → 0
1011 → B
0101 → 5
1111 → F
1100 → C

FIG. 18

TABULAR ENCODING SCHEME FOR
5 AND 6 BIT ENCODING OF
"B>A"

FIVE BIT ENCODING*



*ASSUME INITIAL GROUP TO BE GROUP 1 AND INITIAL CASE TO BE UPPER CASE FOR EACH GROUP.

SIX BIT ENCODING*

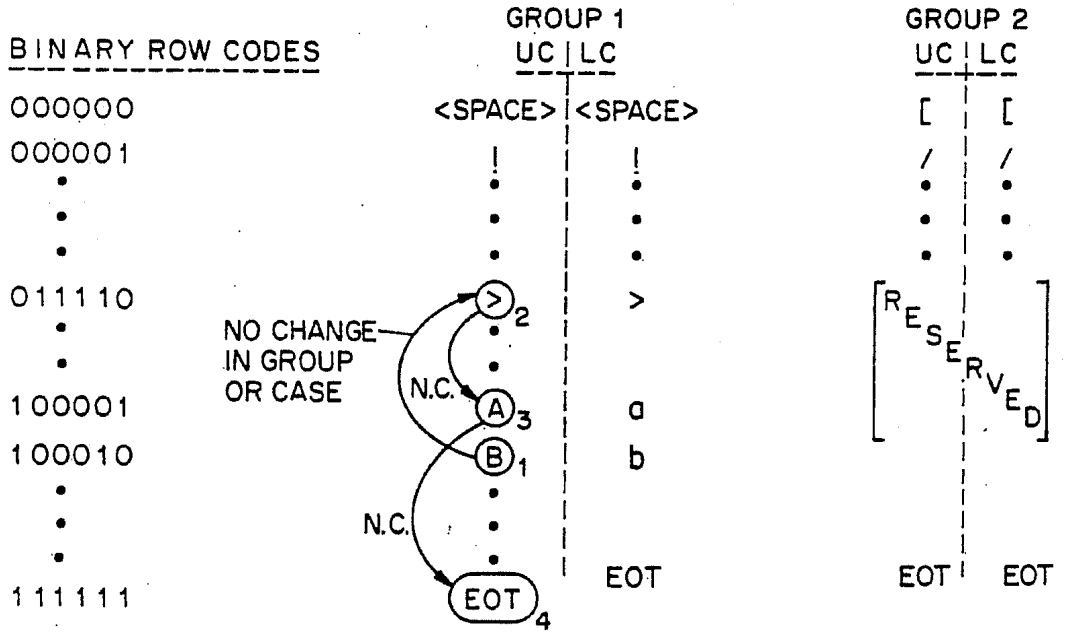


FIG. 19

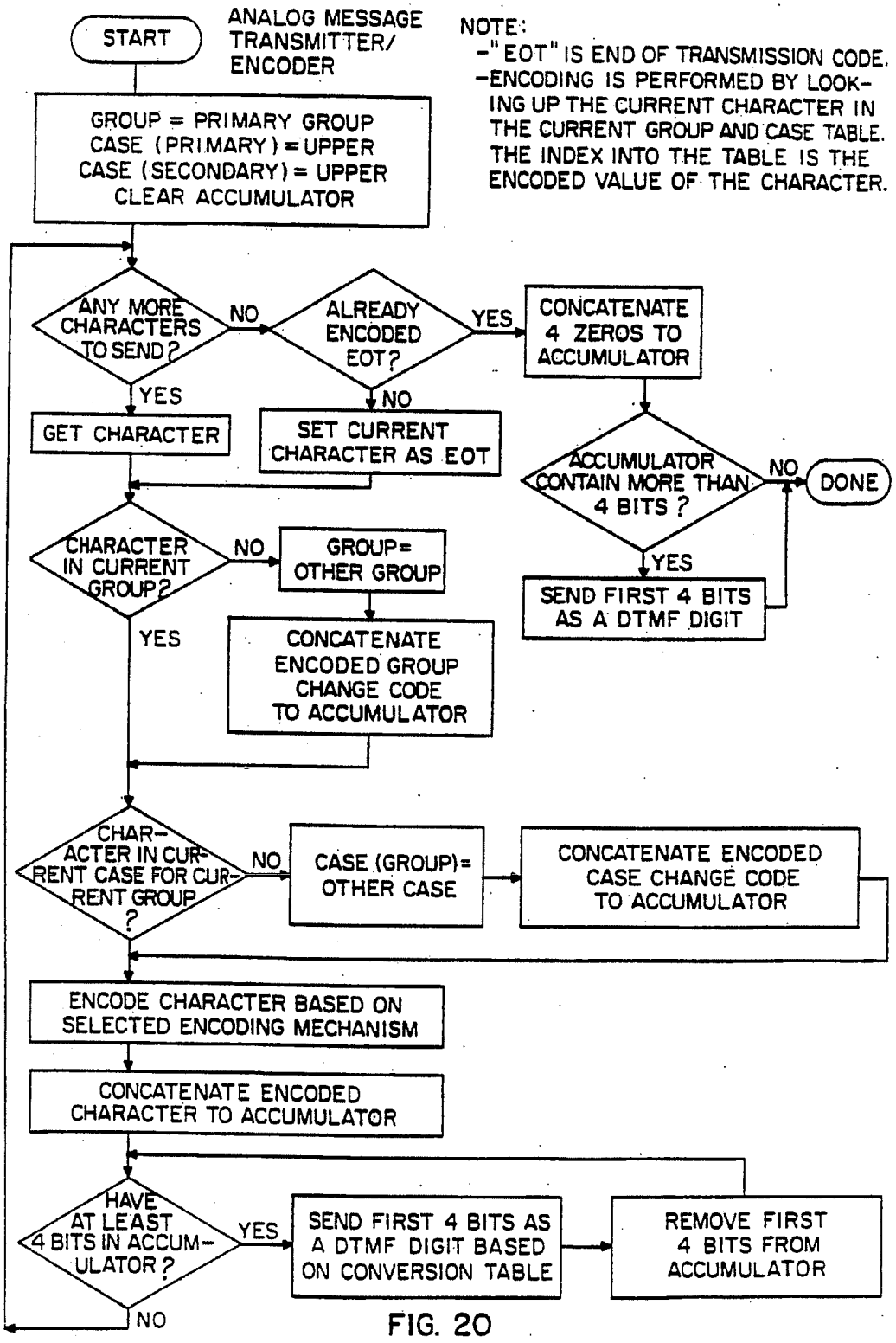

START
ANALOG MESSAGE TRANSMITTER/ ENCODER
NOTE:
-"EOT" IS END OF TRANSMISSION CODE.
-ENCODING IS PERFORMED BY LOOKING UP THE CURRENT CHARACTER IN THE CURRENT GROUP AND CASE TABLE. THE INDEX INTO THE TABLE IS THE ENCODED VALUE OF THE CHARACTER.
GROUP = PRIMARY GROUP
CASE (PRIMARY) = UPPER
CASE (SECONDARY) = UPPER
CLEAR ACCUMULATOR
ANY MORE CHARACTERS TO SEND?
NO
ALREADY ENCODED EOT?
YES
CONCATENATE 4 ZEROS TO ACCUMULATOR
YES
NO
GET CHARACTER
SET CURRENT CHARACTER AS EOT
ACCUMULATOR CONTAIN MORE THAN 4 BITS ?
NO
DONE
YES
SEND FIRST 4 BITS AS A DTMF DIGIT
CHARACTER IN CURRENT GROUP?
NO
GROUP= OTHER GROUP
YES
CONCATENATE ENCODED GROUP CHANGE CODE TO ACCUMULATOR
CHARACTER IN CURRENT CASE FOR CURRENT GROUP ?
NO
CASE (GROUP)= OTHER CASE
CONCATENATE ENCODED CASE CHANGE CODE TO ACCUMULATOR
ENCODE CHARACTER BASED ON SELECTED ENCODING MECHANISM
CONCATENATE ENCODED CHARACTER TO ACCUMULATOR
HAVE AT LEAST 4 BITS IN ACCUMULATOR ?
YES
SEND FIRST 4 BITS AS A DTMF DIGIT BASED ON CONVERSION TABLE
REMOVE FIRST 4 BITS FROM ACCUMULATOR
NO

FIG. 20

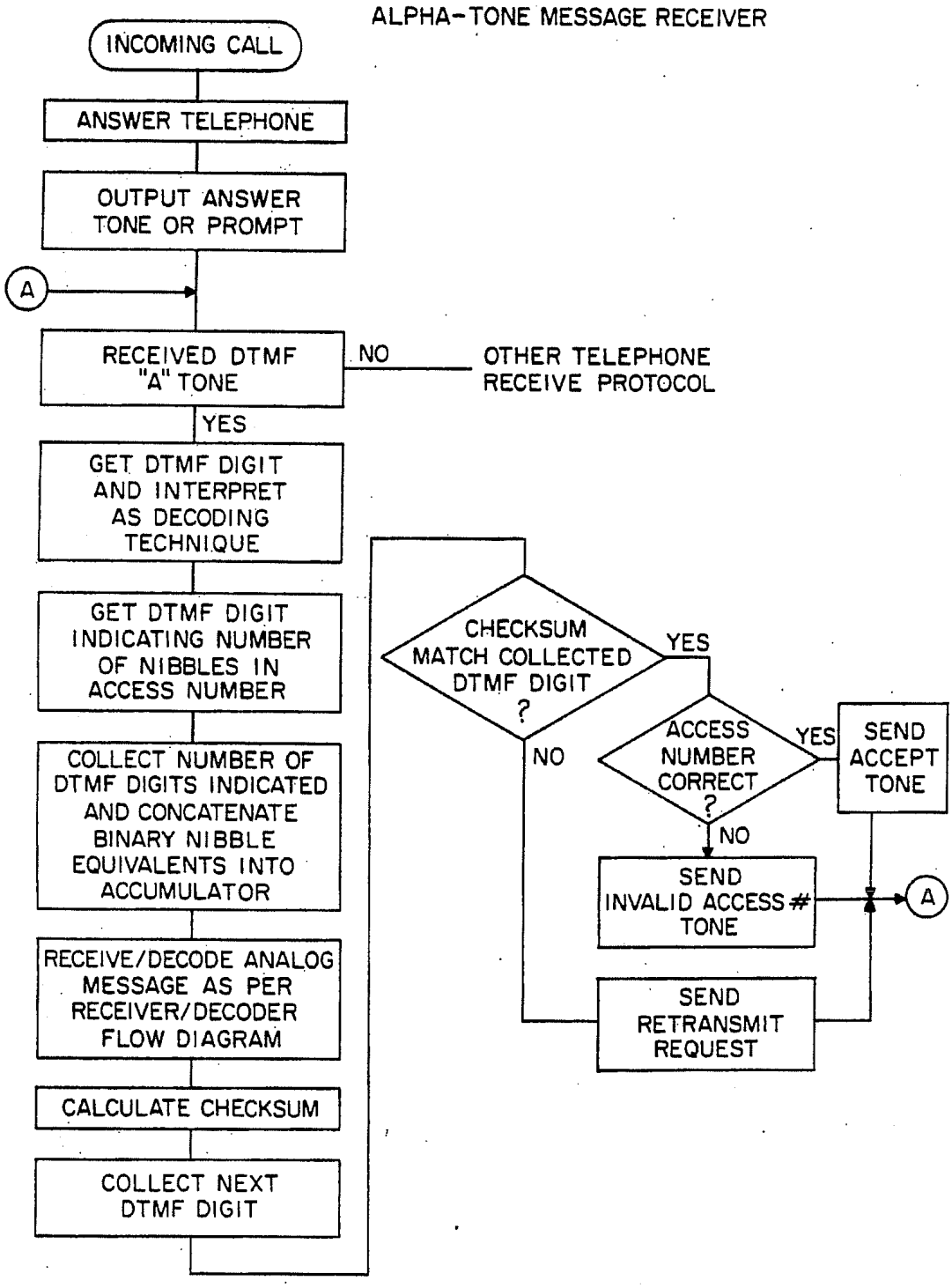

ALPHA-TONE MESSAGE RECEIVER
INCOMING CALL
ANSWER TELEPHONE
OUTPUT ANSWER TONE OR PROMPT
A
RECEIVED DTMF "A" TONE
NO
OTHER TELEPHONE RECEIVE PROTOCOL
YES
GET DTMF DIGIT AND INTERPRET AS DECODING TECHNIQUE
GET DTMF DIGIT INDICATING NUMBER OF NIBBLES IN ACCESS NUMBER
COLLECT NUMBER OF DTMF DIGITS INDICATED AND CONCATENATE BINARY NIBBLE EQUIVALENTS INTO ACCUMULATOR
RECEIVE/DECODE ANALOG MESSAGE AS PER RECEIVER/DECODER FLOW DIAGRAM
CALCULATE CHECKSUM
COLLECT NEXT DTMF DIGIT
CHECKSUM MATCH COLLECTED DTMF DIGIT ?
YES
NO
ACCESS NUMBER CORRECT ?
YES
SEND ACCEPT TONE
NO
SEND INVALID ACCESS # TONE
A
SEND RETRANSMIT REQUEST

FIG. 21

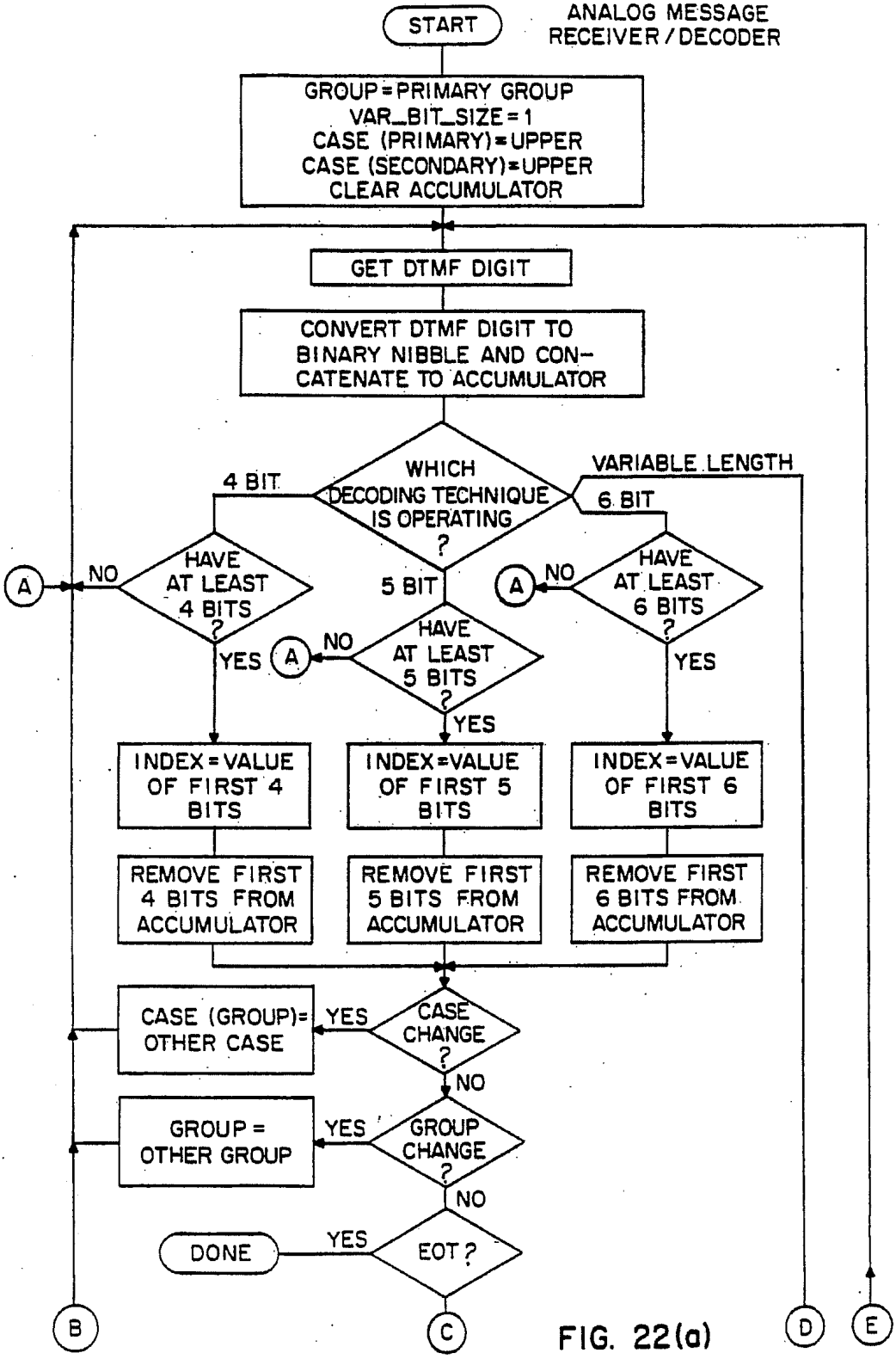

START
ANALOG MESSAGE RECEIVER / DECODER
GROUP = PRIMARY GROUP
VAR_BIT_SIZE = 1
CASE (PRIMARY) = UPPER
CASE (SECONDARY) = UPPER
CLEAR ACCUMULATOR
GET DTMF DIGIT
CONVERT DTMF DIGIT TO BINARY NIBBLE AND CONCATENATE TO ACCUMULATOR
WHICH DECODING TECHNIQUE IS OPERATING ?
4 BIT
5 BIT
6 BIT
VARIABLE LENGTH
HAVE AT LEAST 4 BITS ?
HAVE AT LEAST 5 BITS ?
HAVE AT LEAST 6 BITS ?
NO
YES
A
INDEX = VALUE OF FIRST 4 BITS
INDEX = VALUE OF FIRST 5 BITS
INDEX = VALUE OF FIRST 6 BITS
REMOVE FIRST 4 BITS FROM ACCUMULATOR
REMOVE FIRST 5 BITS FROM ACCUMULATOR
REMOVE FIRST 6 BITS FROM ACCUMULATOR
CASE CHANGE ?
CASE (GROUP) = OTHER CASE
GROUP CHANGE ?
GROUP = OTHER GROUP
EOT ?
DONE
B
C
D
E

FIG. 22(a)

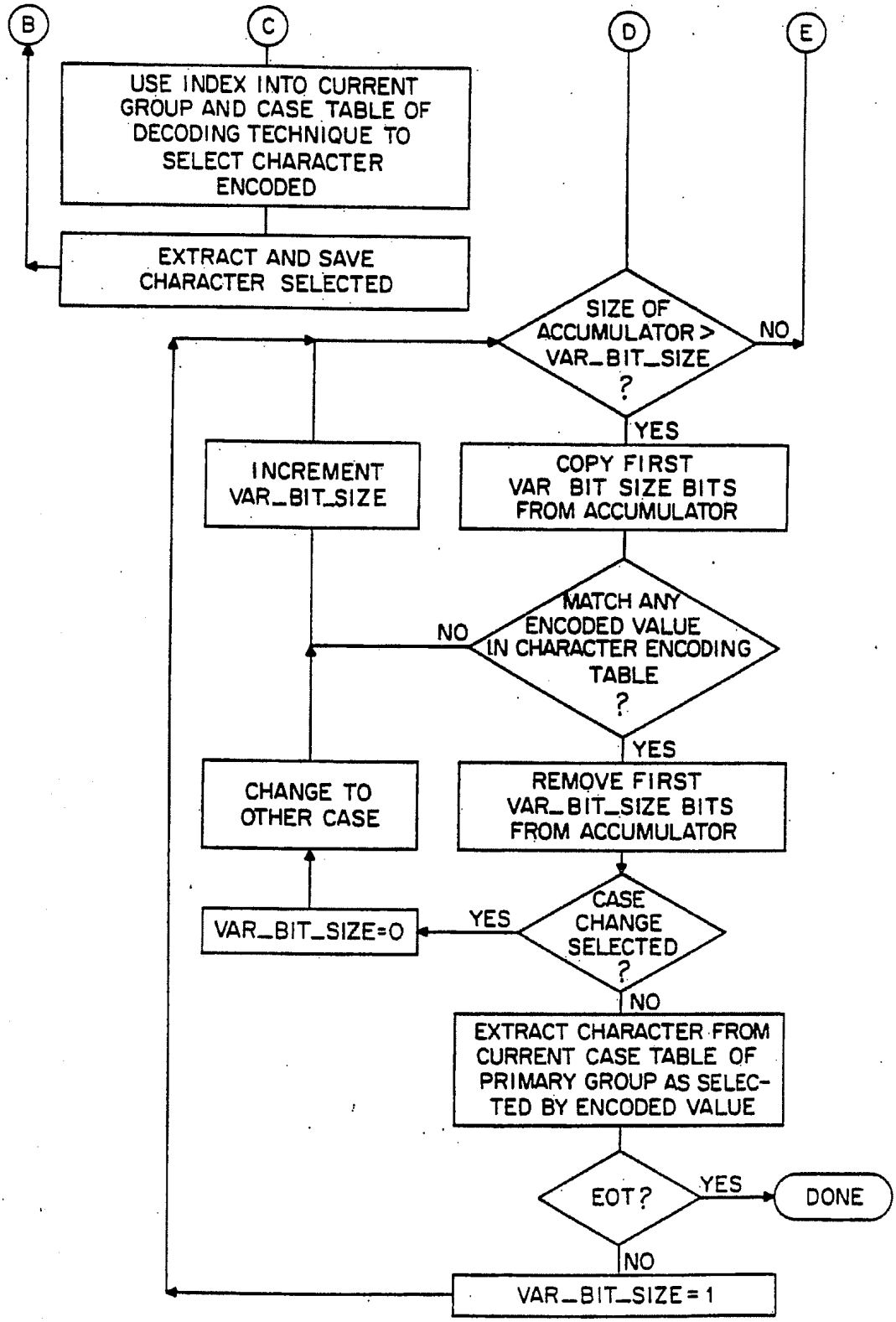

B
C
D
E
USE INDEX INTO CURRENT GROUP AND CASE TABLE OF DECODING TECHNIQUE TO SELECT CHARACTER ENCODED
EXTRACT AND SAVE CHARACTER SELECTED
SIZE OF ACCUMULATOR > VAR_BIT_SIZE ?
NO
YES
INCREMENT VAR_BIT_SIZE
COPY FIRST VAR BIT SIZE BITS FROM ACCUMULATOR
MATCH ANY ENCODED VALUE IN CHARACTER ENCODING TABLE ?
NO
YES
CHANGE TO OTHER CASE
REMOVE FIRST VAR_BIT_SIZE BITS FROM ACCUMULATOR
VAR_BIT_SIZE=0
YES
CASE CHANGE SELECTED ?
NO
EXTRACT CHARACTER FROM CURRENT CASE TABLE OF PRIMARY GROUP AS SELECTED BY ENCODED VALUE
EOT?
YES
DONE
NO
VAR_BIT_SIZE = 1

FIG. 22(b)

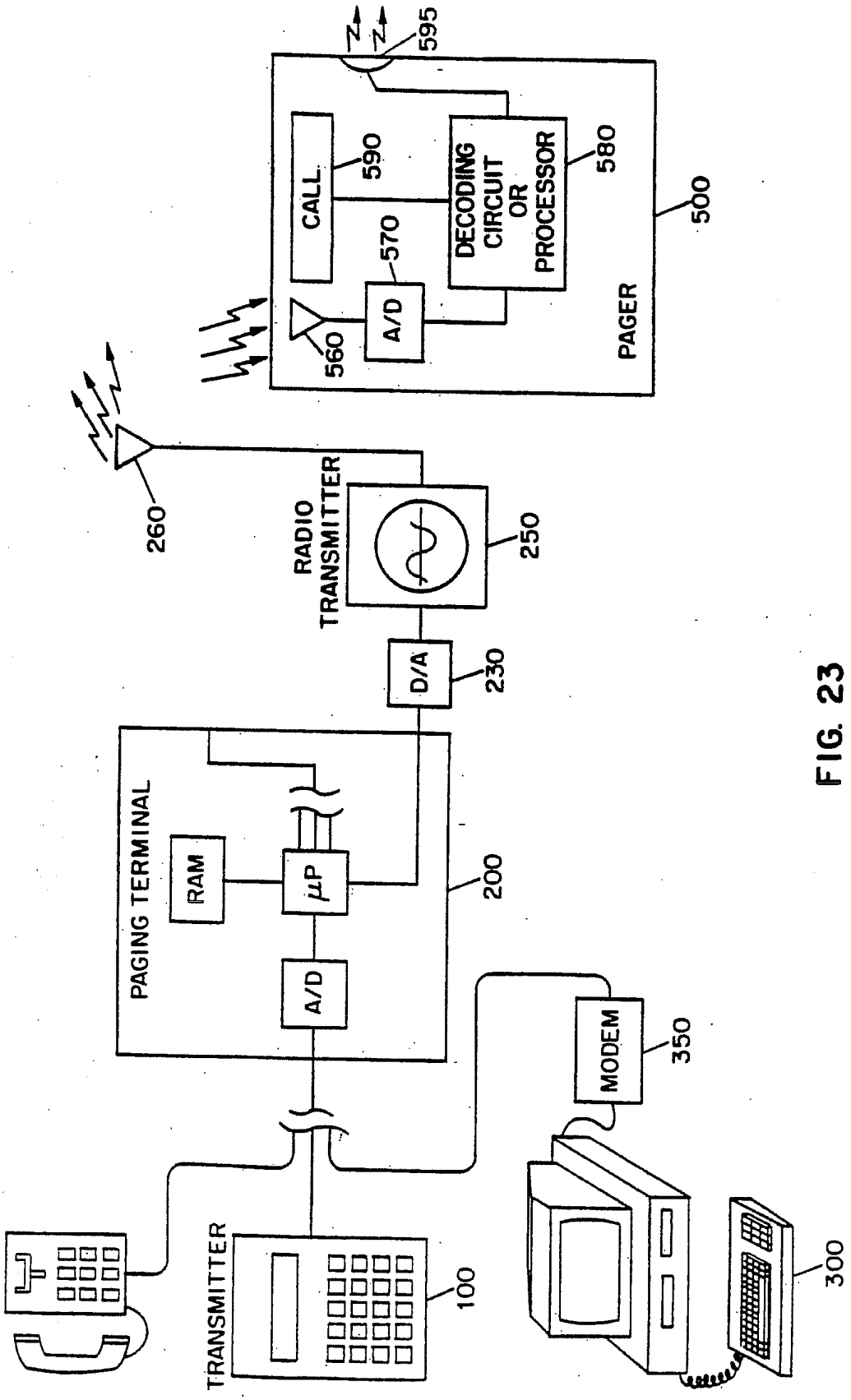

595
CALL
590
DECODING CIRCUIT OR PROCESSOR
580
570
A/D
560
PAGER
500
260
RADIO TRANSMITTER
250
D/A
230
PAGING TERMINAL
RAM
μP
A/D
200
MODEM
350
TRANSMITTER
100
300

FIG. 23

DTMF REPRESENTATION OF
ENCODING MODE USED BY TRANSMITTER

HEX DIGIT	COMPRESSION TECHNIQUE
0	4 BIT ENCODING
1	5 BIT ENCODING
2	6 BIT ENCODING
3	HUFFMAN ENCODING - AMERICAN ENGLISH
4	RESERVED: HUFFMAN - BRITISH ENGLISH
5	RESERVED: HUFFMAN - FRENCH
6	RESERVED: HUFFMAN - SPANISH
7	RESERVED: HUFFMAN - GERMAN
8	RESERVED: HUFFMAN - ITALIAN
9	RESERVED: HUFFMAN - DUTCH
A	RESERVED: HUFFMAN - PORTUGUESE
B	RESERVED: HUFFMAN - BRAZILIAN
C	RESERVED: HUFFMAN - DANISH
D	RESERVED: HUFFMAN - SWEDISH
E	RESERVED: HUFFMAN - NORWEGIAN
F	RESERVED: EXTENDED CODE

FIG. 24

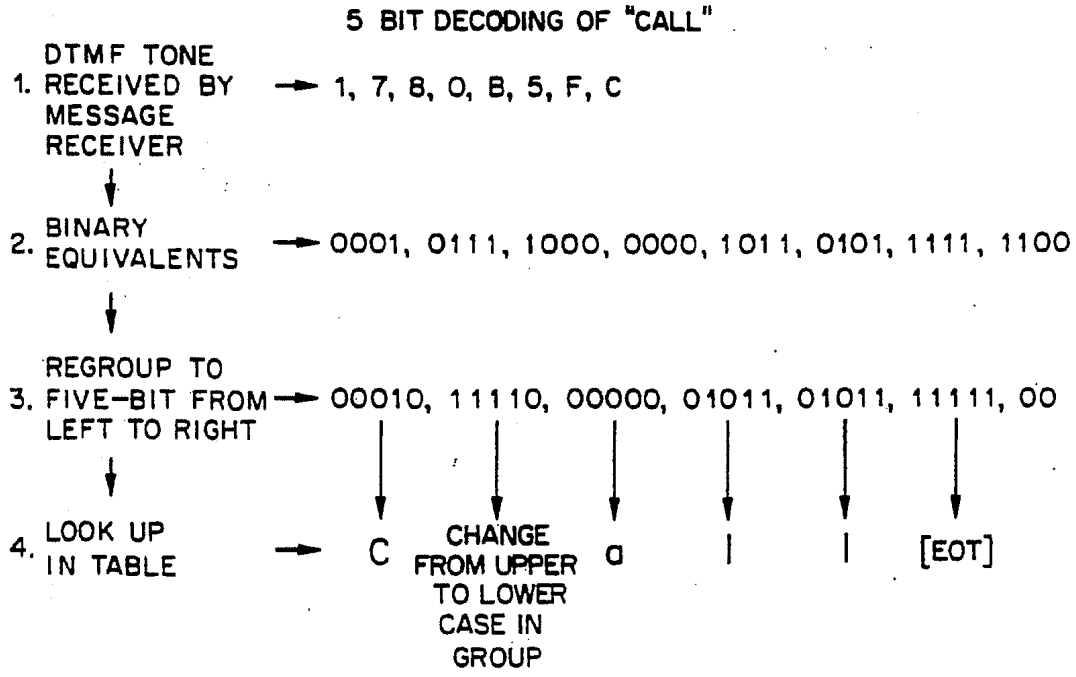


FIG. 25

HANDHELD FACSIMILE AND ALPHANUMERIC MESSAGE TRANSCEIVER OPERATING OVER TELEPHONE OR WIRELESS NETWORKS

FIELD OF THE INVENTION

The present invention relates generally to a method and apparatus for transmitting data to data-receiving devices and, more particularly to a portable handheld facsimile transmitter capable of communicating with other message receiving hosts using different communication techniques to communicate alphanumeric messages.

BACKGROUND OF THE INVENTION

In recent years society has become increasingly dependent on the use of electronic data communication to deliver messages and information. As a result of this increased dependency, it has become increasingly important to have access to such media of communications wherever one may be.

One of the most popular media of electronic communication in recent years is the facsimile machine. These machines have now become commonplace in large and small businesses and in homes. The traditional facsimile machine has been a bulky nonportable machine that requires the user to prepare a paper document to be fed to the machine; the machine then scans and transmits the document to a similar machine.

Although mobile battery powered facsimile machines exist, these machines also tend to be bulky and cumbersome to transport. Rather than carry them around, most people tend to rely on the use of a fixed facsimile machine. When traveling, it is commonplace to have to pay to use a machine provided by a hotel or copy center.

Another area in which demand has grown in recent years is the paging industry. Pagers come in different models, some of which simply "beep", and others which display a specific number or message on a small screen. These pagers usually require a person seeking to activate another's pager to telephone a paging terminal and identify the pager to be activated. The paging terminal then sends out a radio frequency signal and activates the specified pager. With some pagers, the transmitted message can include alphanumeric messages. The person sending such a message is usually required to call up a service provider and to recite the message. The service provider keys in the message into a paging terminal which in turn delivers the desired message to the pager by radio signals.

There is thus a need for a portable handheld device for communicating alphanumeric messages to facsimile machines.

There is further a need to provide a portable handheld message transmitter capable of accessing paging terminals and communicating data required to direct a paging terminal to activate a desired pager and send a desired message thereto. There is also a need for a character transmission protocol for communicating alphanumeric character between a message transmitter and a data receiving host and to provide a transmitter capable of communicating such a protocol and a receiver for receiving such a protocol.

Finally, there is a need for a portable handheld message transmitter for communicating with a number of message receiving hosts having differing data communication types.

SUMMARY OF THE INVENTION

In accordance with the invention a portable message transmitter is provided which comprises an input means for receiving alphanumeric characters and commands from a user and for generating signals indicative thereof, a display means for displaying characters indicative of signals provided thereto, destination selection means for selecting a destination device, for establishing a transmission path in a switched network, and for determining an appropriate data type for the selected destination device. The transmitter further comprising message holding means responsive to signals generated by the input means for holding words of binary data indicative of a message from the user, each word associated with a particular character in the message; waveform synthesis means responsive to the data type being a first one of the at least two predetermined data types, for deriving pixel-map data indicative of rows of the perceived shape of the characters associated with the words of binary data, for producing bit streams indicative of the pixel-map data, and for synthesizing differential phase-shift key waveforms corresponding to the bit streams, whereby the waveforms may be received by a device recognizing said differential phase-shift key waveforms; waveform synthesis means further responsive to the said data type being a second one of the at least two predetermined data types, for deriving and queuing binary-coded signals associated with the words of binary data, for providing the signals in nibbles composed of fewer bits than the number of bits in the binary-coded signals, and for synthesizing dual-tone multifrequency waveforms indicative of the nibbles; and coupling means for coupling said synthesized waveforms to a transmission line.

In addition, a portable hand held message transmitter for use in selecting a destination device capable of receiving differential phase-shift key waveforms over a switched network is provided which comprises input means for receiving alphanumeric characters and commands from a user and for generating signals indicative thereof, display means for displaying characters indicative of signals provided thereto, destination selection means responsive to signals generated by the input means for selecting the destination device from among the plurality of destinations devices and for establishing a transmission path in the switched network, message holding means responsive to signals generated by the input means for holding words of binary data indicative of a message from the user, each word associated with a particular character in the message, waveform synthesis means for deriving pixel-map data indicative of rows of the perceived shape of the characters associated with the words of binary data, for producing bit streams indicative of the pixel-map data and for synthesizing differential phase-shift key waveforms corresponding to the bit streams by controlling a differential phase-shift key waveform generator for communicating with devices capable of recognizing said differential phase-shift key waveforms, and coupling means for coupling the synthesized waveforms to a transmission line.

In order to better communicate alphanumeric messages from a transmitter to a receiver, a protocol is also provided for communicating messages between a transmitter and a receiver. A transmitter capable of sending such messages is provided which comprises input means

for receiving characters from a user and for generating corresponding binary-coded character signals indicative of the received characters, the character signals comprising a number of bits sufficient to permit a unique signal for each of the user-inputtable characters, lookup means with respect to a lookup table having a plurality of rows associated with binary-coded row numbers and two column-pairs associated with a plurality of respective groups, each column-pair comprising two columns each associated with one case of an upper case and a lower case, with ones of the intersections of the rows and columns associated with ones of the unique signals, said lookup means responsive to ones of the character signals indicative of the received characters for determining the row and column associated therewith, for determining the binary-coded row number associated with the row, and for determining the case and group associated with the column, group encoding means having an initial group state and an initial case state, said group encoding means responsive to receipt of a one of the character signals indicative of the received characters for providing the one of the character signals indicative of the received characters to the lookup means and receiving the group and case and binary-coded row number associated with the one of the character signals indicative of the received characters, said group encoding means further responsive to receipt of the group associated with the one of the character signals indicative of the received characters for comparing said group with the previous group state and generating a change-of-group signal in the event of a difference therebetween, said group encoding means further responsive to receipt of the case associated with the one of the character signals indicative of the received characters for comparing said case with the previous case state and generating a change-of-case signal in the event of a difference therebetween, and for generating a row signal associated with the binary-coded row number, the change-of-case and change-of-group signals having the same number of bits as the binary-coded row numbers, queuing means for receiving and queuing the generated signals and for providing the signals in nibbles composed of fewer bits than the number of bits in the binary-coded row numbers, and analog means for receiving the nibbles, for producing analog signals indicative thereof, and for coupling said analog signals to a transmission line. The protocol can be made to incorporate efficient representation techniques such as Huffman encoding and this can in turn be included as an option on the transmitter using the protocol.

In addition to the transmitter, a receiver is also provided which can receive and decode messages from a transmitter sending messages encoded with this protocol. The receiver also makes use of a lookup table to decode incoming analog signals after they have been digitized, serialized and regrouped into the appropriate digital bit length.

BRIEF DESCRIPTION OF THE DRAWINGS

The exemplary embodiment will be explained with respect to a number of figures, of which:

FIG. **1** is a system block diagram of a handheld message transmitter in accordance with an embodiment of the present invention.

FIG. **2** is a data-flow diagram of the transmitter of FIG. **1** showing data flow from the keyboard to the telephone line;

FIG. **3** shows in schematic form the analog circuitry relating to the telephone line interface of the transmitter of FIG. **1**;

FIG. **4** shows front and side views of the transmitter of FIG. **1**;

FIG. **5** shows in state diagram form the user menus of the transmitter of FIG. **1**;

FIG. **6** shows in tabular form a correspondence between DTMF tones and displayable characters in four bit encoding mode;

FIG. **7** shows in tabular form a five-bit encoding system for displayable characters;

FIGS. **8A** and **8B** taken together show in tabular form a six-bit encoding system for displayable characters;

FIGS. **9A** and **9B** show in character order a Huffman encoding scheme;

FIGS. **9C** and **9D** show in bit-length code order a Huffman encoding scheme;

FIG. **10** shows a generic sine waveform to be synthesized or approximated;

FIG. **11** shows in partial view a table of values for use in synthesizing or approximating a sine waveform;

FIG. **12** shows the wave shape of a sine wave including a phase-change transition;

FIG. **13** shows part of a flowchart showing in block diagram form the steps of sending a facsimile message;

FIG. **14** shows in tabular form the frequencies of the sixteen standardized DTMF (dual tone multifrequency) signaling tones and the nibbles they represent in binary and hexadecimal code;

FIG. **15** illustrates a DTMF waveform generation technique;

FIG. **16** shows in flowchart form the method for sending messages via the tone protocol according to the invention;

FIG. **17** shows in tabular form one set of corresponding values used in decoding four, five, six-bit and Huffman encoded data;

FIG. **18** illustrates the five-bit encoding of a sample message;

FIG. **19** illustrates five-bit and six-bit encoding of a sample message according to the tabular structure shown herein;

FIG. **20** shows in flowchart form the encoding process for five, six-bit and Huffman coding;

FIG. **21** shows in flowchart form the method for receiving messages via the tone protocol according to the invention encoded data;

FIG. **22**(*a*) and **22**(*b*) shows in flowchart form the decoding process for four, five, six-bit and Huffman encoded data;

FIG. **23** is a system block diagram of a message transmitting and receiving system in accordance with the present invention;

FIG. **24** shows in tabular form a set of predetermined messages to be exchanged between transmitter and host to indicate the type of message being communicated; and

FIG. **25** illustrates five-bit decoding of a sample message.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **4** shows front and side views of a handheld message transmitter in accordance with an embodiment of the present invention. The transmitter **100** is capable of sending alphanumeric messages to Group III facsim-

ile machines and to paging terminals using a variety of data communication protocols. The transmitter is designed to provide a variety of user functions including calculator, clock, calendar and electronic date book functions in addition to providing a means for communicating alphanumeric messages to message receivers.

The external case of the transmitter **100** includes a keypad **10**, an LCD display **13**, a volume control **51** and a phone line connector **60**. The dimensions and weight of the transmitter are such that the entire transmitter can be easily held in the palm of one's hand and can fit into one's shirt pocket. The phone jack **60** provides a means of connecting the transmitter **100** via a connecting cord (not shown) to a switched network such as a telephone line. The volume control knob **51** is a potentiometer for adjusting the output of an internal piezoelectric transducer or speaker. The internal speaker provides the user with a key click sound to tell the user that a key in the keypad **10** has been depressed, and also provides the user with a means of monitoring the telephone line when the transmitter is trying to establish communication with the selected message receiver.

A system block diagram for the above transmitter **100** is shown in FIG. **1**. A keypad **10** and system controller **40** are coupled to an address/data bus of the transmitter. System controller **40** monitors the address/data bus lines and detects input signals from the keypad **10**. These signals are decoded by the system controller **40** which provides corresponding control signals to the LCD display **13**, the telephone input/output subsystem **20** and a speaker **50**. The keypad **10** and the display **13** together with associated software provide a means for the user to control all the functions of the transmitter **100**. The keys are multifunctional keys: they can be used as alphanumeric character keys to enter alphanumeric data, and as command function keys to control the operation of the transmitter. The use of multifunctional keys, as shown in FIG. **4**, helps to minimize space requirements for the keyboard.

LCD display **13** provides user information by displaying messages, command requests, system progress signals and a cursor indicative of the mode of operation of the transmitter. Because of size constraints, the LCD display **13** can only display a limited number of alphanumeric characters at a time. When a greater number of characters is provided to the display **13** than can be displayed at any one time, the system controller **40** allows a user to scroll through the displayable characters with the use of directional keys on the keypad. The LCD display is controlled generally through the system controller **40** shown in FIG. **1**.

As shown in FIG. **1**, the system controller **40** of the transmitter **100** consists of a Z80 microprocessor **11**, ROM memory **14**, RAM memory **15**, an Application Specific Integrated Chip ("ASIC") **12**, and various address/data and control lines. The ASIC **12** has lines which are connected directly to segment and backplane electrodes of the LCD display **13** and includes circuitry which updates the electrodes sufficiently to refresh the display **13**. In addition to this display control function, the ASIC **12** also controls the memory management of the transmitter, including bank switching. Because the Z80 may address only 64k of memory directly with its address lines, memory banking operations need to be performed to access additional memory required by the system. Upon the receipt of a change bank signal from the Z80 microprocessor **11**, the ASIC **12** is programmed to select and latch the appropriate bank of memory to be addressed by the Z80 microprocessor. The ASIC **12** also provides power up, power down and real time display and updating functions.

The Z80 microprocessor **11** provides all the human interface and high level program management for the system controller **40**. For instance, the Z80 microprocessor **11** reads the keys of the keypad **10**, manages scrolling of the display **13**, manages data files stored in memory and runs the calculator, directory, fax send and paging communication programs stored in the ROM **14** and RAM **15** memory. The transmitter operational functions will be further explained below.

In addition to the system controller **40**, the transmitter has a telephone input/output interface **20** (hereinafter TIO). Eight bits of parallel data may be sent by the Z80 microprocessor **11** through a parallel-to-serial converter **8**. As explained below, the TIO **20** functions to produce synthesized waveforms to be placed over a communication channel according to instructions received from the Z80 microprocessor **11**.

FIG. **3** shows a more detailed block diagram of the TIO **20**. In FIG. **3**, a Z8 microcomputer **25** receives serial bits of data from the parallel-to-serial converter **8**. The Z8 microcomputer **25** includes an internal processor, ROM, RAM and registers. Discrete output lines in an output port of the Z8 microcomputer **25** are coupled to a digital-to-analog converter **26**. The digital-to-analog converter **26** is preferably a R-2R resistor array, or can be a commercially available D/A chip. The analog signal is then passed through a buffer operational amplifier D1 and a 3.5 kHz lowpass filter **23**. The signal is then coupled to a telephone input line TI in a telephone interface chip **27** and to a speaker **50**. The telephone interface chip **27** is an MC34014 silicon monolithic integrated circuit available from the MOTOROLA (TM) Company of Phoenix, Ariz. 85036, and the speaker is a common piezo transducer.

If the signal output by the Z8 microcomputer **25** is a signal to be placed over the telephone line, the Z8 microcomputer **25** turns transistor Q3 on. The telephone interface chip **27** then drives the signal received from the low pass filter **23** through a diode bridge and a spike suppression zener diode Z2 to a telephone line by way of a telephone jack **29**. If the signal is not one to be placed over the telephone line but is one directed to the speaker **50**, transistor Q3 is turned off causing any output to the telephone line to be suppressed. The signal from the low pass filter is carried to the speaker **50** by way of operational amplifier **03**. However, the output to the speaker **50** may also disconnected by the Z8 microcomputer **25** by turning transistor Q2 on. This effectively mutes the speaker output. Otherwise, the speaker **50** will produce an audio output corresponding to the signal applied to the operational amplifier **03** as controlled by the variable resistor VR1. The variable resistor VR1 in FIG. **3** corresponds to the volume adjust control **51** in FIG. **4**.

The Z8 microcomputer **25** allows a user to monitor the telephone line by turning transistor Q3 on and transistor Q2 off. This effectively takes the transmitter "off hook" and allows the speaker **50** to reproduce the signal received by the transmitter from the telephone line. This speaker function is used to monitor such occurrences as busy signals, money requests by pay telephones and wrong numbers.

Transistor Q1 provides the Z8 microcomputer **25** with a frequency monitor of signals received by the transmitter. The transistor Q1 acts to produce square

waves representative of any sinusoidal wave received by the transmitter over the telephone line as driven by the telephone interface chip **27**. The coupling of the collector to the Z8 microcomputer **25** allows the Z8 to detect the frequency of any wave by counting the zero crossings. As a result, the Z8 microcomputer **25** may detect carrier signals and other handshake signals received from external message receivers.

FIG. **2** shows a data flow chart of a transmitter incorporating the present invention. Data and command signals are received by a microprocessor **11** from the keyboard **10**. The microprocessor **11** then acts to display the appropriate output on the LCD display **13** by sending the appropriate signals to the ASIC **12**. The ASIC **12** is in turn coupled to the LCD display **13**. The ASIC **12** sends the appropriate data signals to the display **13** for the characters selected by the microprocessor **11**. The ASIC **12** also functions to refresh data signals to the display **13** to maintain the display until such time as the microprocessor **11** calls for a change in the displayed characters on the display **13**.

Signals which are to be delivered to the speaker **50** or telephone jack **29** must be processed through the Z8 microcomputer **25**. Eight bit parallel data bytes are delivered from the Z80 microprocessor **11** to Z8 microcomputer **25** through an 8-bit parallel-to-serial converter. The serial data is received by the Z8 microcomputer **25** which processes the data/command received from the Z80 microprocessor **11**, as for example, a request to access the speaker or to establish telephone communication. If the Z8 microcomputer **25** has been requested to send data to the telephone line, it passes seven-bit parallel signals through the D/A converter **26** to produce an analog signal which is processed through the above-mentioned 3.5-kHz lowpass filter **23**. Depending on instructions received from microprocessor **11**, which determine whether the signal is intended for the speaker **50** or the telephone jack **29**, the Z8 will direct the signal to either the speaker **50** through the use of its "mute" line coupled to transistor Q2, or the telephone interface chip **27** and the telephone jack **29** with the use of "off hook" transistor Q3.

Transmitter Operating Functions Communication Protocols

The communication protocol used by the transmitter of the present invention could vary according to the communication protocol used by the receiver. Amongst the possible protocols available in the transmitter of the present invention are phase shift keying for communication with Group III fax machines, frequency shift keying for communication with standard paging terminals and a dual tone multifrequency communication protocol further explained herein for more efficiently communicating data to a receiver. The transmitter of the present invention must determine the communication protocol required by the receiver selected by the user to receive a message. The transmitter must then designate a message as being of a particular data type, convert and store the message according to a predetermined format, and subsequently communicate the converted message to a selected receiver through a waveform generator. A more detailed explanation of communication protocols that may be implemented in the transmitter of the present invention are provided below.

Facsimile Transmission

The communication protocol for sending and receiving data from a Group III fax machine has been well documented and described in various literature, such as published CCITT Recommendation A.21, "Collaboration with other International Organizations on CCITT-Defined Telematic Services", pertinent parts include Recommendation T.4 "Standardization of Group 3 Facsimile Apparatus for Document Transmission", pp.16–31, and Recommendation T.30 "Procedures For Document Facsimile Transmission In The General Switched Telephone Network", pp. 69–106. The recommendation by the United Nations organization, which in French stands for the International Consultative Committee for Telephone and Telegraph (CCITT), fully explains all the necessary phases for establishing communication, transmitting data and ceasing the communication between devices. The CCITT standard is a worldwide standard for facsimile machines. See INFOWORLD, Mar. 25, 1991, Vol. 13, Issue 12, P. 31.

The protocol set forth in the above literature is implemented in the transmitter of the present invention by the use of the system controller **40** and the TIO **20**, as shown in FIG. **1**. The user selects a message to be delivered to a group 3 facsimile machine by the use of the keypad **10**. The user then selects the phone number of the facsimile machine to receive the message from the transmitter. Both the message and the destination device number are stored in memory. The transmitter also allows the option of transmitting the same message to a number of different receivers with different phone numbers. Once the messages and destination phone numbers have been entered by the user and processed by the microprocessor **11**, the microprocessor **11** converts the text of the message to a series of phase shift signals representing pixel-map data indicative of the physical representation of the alphanumeric characters in the message. This process is carried out by the microprocessor **11** according to well known CCITT standards. Once the message has been converted to the appropriate sequence of phase shifts, and those phase shifts stored in memory, the microprocessor **11** can initiate a telephone connection to the device (e.g. a telecopier) which is to receive the message.

The microprocessor **11** directs the Z8 microcomputer **25** to access a telephone network (not shown) connected to the above jack **29** in order to deliver the transmission to a receiver. The Z8 microcomputer **25** enables an "off hook" line which activates a relay to seize the line and to obtain a dial tone. Both the user and the Z8 microcomputer **25** may now monitor the telephone line through the speaker **50** and the zero-crossing transistor Q1 line feeding back from the telephone line interface chip **27**. Once a dial tone has been received, the Z8 microcomputer **25** delivers the frequency of the signal received back through the telephone line to the microprocessor **11**. The microprocessor **11** then instructs the microcomputer **25** to interpret the subsequent data as either touch tone or pulse tone phone numbers that are to be sent over the telephone network. The microprocessor **11** instructs the microcomputer **25** to dial the specified numbers.

In the case of tone signaling, the microcomputer **25** has an internal lookup table which provides appropriate data signals to the D/A converter **26** and through the low pass filter to produce the correct tone signal to be dialed. The telephone line interface chip **27** then drives

the signal through the diode bridge and to the telephone line.

In the case of rotary signaling, the microcomputer activates the line-seizure relay according to well known and specified timings and duty cycles to simulate rotary dialing.

After dialing the telephone number, the microprocessor **11** waits to receive a group 3 tone over the telephone line as fed back by the telephone line interface chip **27** back through the microcomputer **25** and delivered as serial data bit stream to the microprocessor **11**. Once the appropriate tone is received, the microprocessor **11** instructs the microcomputer **25** to receive phase shift keying dibit signals for transmitting group 3 facsimile messages, and begins delivering dibits of information to the microcomputer **25**. The microcomputer **25** begins processing the dibits as it receives the information and stores the additional dibits in a buffer until it is able to process them. The dibits represent phase shifts in the 1800-Hz carrier frequency recognized by group 3 facsimile machines, as called for by the CCITT standard.

As shown in FIGS. **10** and **11**, the 1.800 Hz carrier frequency is produced by the microcomputer **25** according to a lookup table and a table index pointer. A sine wave of a unit amplitude is divided into 256 equally spaced time amplitude values, i.e. T0, T1, T2 . . . T255. The amplitude values are stored in the microcomputer's **25** memory with an index pointer set initially at T0. The index points to the value which is to be output by the microcomputer **25** to the D/A converter **26**. The index is displaced a sufficient number of times per second to be within the plus or minus 1-Hz error region allowed for group 3 facsimile machines. The index is sufficiently updated to produce the 1800 Hz sine wave until a dibit is received from the microprocessor **11** to indicate a change in phase is needed for the sine wave. When the microcomputer **25** receives a change in phase dibit, the microcomputer **25** calculates how far ahead the index needs to be displaced in order to produce the phase shift desired by the microprocessor **11** requested by the dibit. Once the index is displaced the index will sample the lookup table at the same rate it did before receiving the change in phase dibit in order to retain the 1800 Hz sine wave. In generating a phase shift, the displacement of the index from the next normal position provides a phase shift in proportion to the number of entries skipped. For instance, in FIG. **12** the index is updated after T63 to represent a 45-degree phase shift in the sine wave by advancing the index from T64 to T97. The formula for calculating the number of amplitude values to ship for a given phase shift is:

$$\text{index displacement} = \frac{\text{number of amplitude values per sine wave}}{} \times \left[\frac{\text{phase shift (in degrees)}}{360^\circ}\right]$$

In the example above, where a 45° phase shift is desired, the index displacement would equal

$$\frac{256 \text{ values}}{\text{sine wave}} \times \left(\frac{45^\circ}{360^\circ}\right) = 32 \text{ values}$$

Assuming the next amplitude value would have been T65, the index pointer would skip 32 values forward to T97. This would in effect generate a 45° phase shift in the 1800 Hz output carrier frequency of the transmitter.

The microcomputer **25** updates the index until it receives an end of transmission (EOT) signal from the microprocessor **11**. Upon the receipt of an EOT signal from the microprocessor **11**, the microcomputer **25** sends an EOT signal to the facsimile machine and begins the termination process for group 3 facsimile machines as defined by the CCITT, which requires an EOT acknowledge signal from the facsimile machine. The tone generated from the facsimile machine is detected by the zero-crossing transistor Q1 in the telephone input/output circuit **20** and delivered to the microprocessor **11** which instructs the microcomputer **25** to terminate communication over the phone line.

The above steps are outlined in FIG. **13** and are repeated for each message that needs to be sent by the transmitter.

Dual Tone Generation

The generation of dual tone modulated frequencies (DTMF) is used to dial phone numbers in a touch tone mode of operation and to communicate messages over a telephone line using a DTMF communication protocol explained below. As shown in FIG. **14**, DTMF operation requires the production of sine waves of different frequencies and combining two of them to produce a distinct signal identifiable by a receiver. For example, a DTMF tone signal 3 is produced by generating a 1477-Hz sine wave and a 697-Hz sine wave; as described below, the two sine waves are combined in software to form a single dual-tone waveform. In order to produce sixteen DTMF signals four high frequencies and four low frequencies need to be produced by the system. The high frequencies are 1209 Hz, 1336 Hz, 1477 Hz and 1633 Hz. The four low level frequencies are 697 Hz, 770 Hz, 852 Hz and 941 Hz. DTMF signals **0-9** in FIG. **14** are used to generate the standard touchtone telephone signals over the phone lines in order to connect with a receiver through the telephone switching network. DTMF signals shown as hexadecimal values A–F are used to communicate with message receivers according to protocols described below.

The DTMF signals are produced in the transmitter by the telephone input/output circuit in FIG. **3**. The microcomputer **25** receives a binary bit representation of one or another of the sixteen possible DTMF combinations from the microprocessor **11** in the system controller. The binary nibble is interpreted by the microcomputer **25** according to the chart in FIG. **14** and the microcomputer generates binary representations of the sum of the two frequencies corresponding to the DTMF digit to be placed over the telephone line.

The microcomputer **25** generates sine waves by using a lookup table and index pointers as described with the facsimile transmission method discussed above. Because two frequencies need to be produced, two different index pointers are provided. As mentioned above, one period of a sine wave is stored in a table representing a number of equally spaced time intervals. However, because of the symmetrical nature of the sine wave, only a portion of the wave needs to be placed in memory. The run-time software could dynamically exploit symmetries in sine wave polarity and slope to compress the stored wave form. This would have the benefit of reducing required memory storage area but would consume some of the available computational bandwidth of

the synthesis software. In the simple case the entire sine wave is being stored in the table.

Because the microcomputer **25** is adding two sine waves together when producing DTMF signals, the sine wave table used for DTMF is different from the single tone frequency table. The addition of the two sine waves may produce amplitudes exceeding the rated value of the D/A converter **26** in the TIO circuit **20** thereby causing "clipping" of the signal as shown in FIG. **15**. To avoid clipping of the DTMF tone signal, the sine wave table for the DTMF generation is scaled down to half amplitudes to avoid exceeding the rated value of the D/A converter **26**. Optionally this could also be done through the existing sine wave table with additional processing but this would either require additional processing time or additional logic chips. The use of different tables also allows the full use of the quantization range of the D/A converter **26**.

In FIG. **15** an example of the generation of DTMF signal of the present invention is provided. The generation of different frequencies is done by setting the initial indices to zero, $i_{(1)}$ and $i_{(2)}$, determining the number of samples to be made per second and determining the time increment per sample, ΔT, and then determining the number table entries to be skipped by the index on each sample, $\alpha_{(1)}$ and $\alpha_{(2)}$. This is done for two different frequencies with two different indices. The values of the two indices are summed and an output is generated by the microcomputer **25** to the D/A converter **26** and passed onto the telephone line. The time increment, ΔT, represents the time between samples for both indices, i_1, and i_2. This value, ΔT, is generally a product of the frequency of the sine waves to be generated and the number of amplitude values in the amplitude table **200**. Thus, if a frequency of 1 Hz was desired and the table had 256 amplitude values for one sine wave, 256 samples would be taken per second. Thus, ΔT would be 1/256 of a second. This assumes, of course, that the 256 entries on the chart provide sufficient accurate results for the desired output. In the instant case, a table of 256 entries has provided sufficient accuracy to produce a 1800 Hz carrier frequency to within (+) or (−) 1 Hz. Indices i_1 and i_2 would, in FIG. **15**, ship α_1 and α_2 entries, respectively, every ΔT seconds. Index pointer i_2 skips more entries per second than i_1 and therefore represents a higher frequency sine wave than i_1.

The sample rate is bounded by the Nyquist rate as the minimum rate and by some integer division of the processor clock speed as a maximum. Within this range, the sampling rate is chosen to yield the best mix of frequency errors for the task at hand. Integer indexed table synthesis techniques also have another limitation in that the only frequencies that are an integer multiple of the fundamental table frequency can be accurately reproduced; non-integer multiples will have some frequency error component. As a result of this, a combination of table size, quantization resolution and sampling frequency is chosen that yields optimum results for the most critical frequency used by the transmitter, herein being the 1800 Hz carrier frequency which requires a (+) or (−) 1 Hz accuracy. If the system were simply implementing the DTMF protocol herein described, the system would only need to be as accurate as the DTMF receiver's error margin, which is more forgiving than the Group 3 facsimile protocol provided by CCITT.

A general flow chart for the tone protocol system using DTMF tones is shown in FIG. **16**. In this communication system, there are a number of different character coding representations from which the transmitter may select. The transmitter encodes the message that is to be sent to the receiver according to each format. The format which requires the fewest number of binary bits to represent the entire message is selected as the character encoding format. The binary bit representation is then serialized and "queued", or regrouped, as four-bit nibbles. The transmitter then sends out DTMF tones representative of the four-bit nibbles as in FIG. **14** to the receiver, which in turn decodes the message according to the information initially received from the transmitter regarding the message encoding protocol used.

The transmitter may select from a number of character coding representations using data compression techniques. The transmitter may represent outgoing characters as 4-bit, 5-bit, 6-bit and variable length binary bit representations. Four-bit encoding may be utilized when the characters in a message consist only of 16 often-used predefined characters, typically numerals only. As shown in FIG. **6**, sixteen characters may be represented through the four-bit encoding. In this technique, each character is converted to its four-bit equivalent and the DTMF tone equivalent to that character is transmitted. One character from the sixteen-character set is reserved to indicate the end of transmission.

Five-bit data compression encoding is capable of transmitting the entire printable ASCII character set. Each character is represented by a five-bit value within a group and case designation. As shown in FIG. **7**, each five-bit binary representation has two corresponding groups and an upper and lower case in each group. In addition, there are five-bit designations for a "switch group" command, a "switch case within the group" command, and some often-used characters such as the space, comma and period. The transmitter encodes the message according to this coding technique by starting out with an initial group designation and an initial case designation for each group.

For purposes of illustration, e.g., assume group 1 and upper case are the initial designations. The transmitter then inspects the characters in the message to be transmitted. Suppose, for example, the message is "Call". The transmitter encodes the message according to the table, as shown in FIG. **18**, and generates a serialized binary bit stream representative of the message. In the example, the first character is a "C" and its five bit representation is "00010". The next character is a lower case "a", thus, the transmitter represents the character by inserting a change-of-case binary bit representation, "11110", and then the appropriate binary row code "00000". Thus, five-bit encoding requires the transmitter to keep track of the group, case and row for each character.

Six-bit encoding is illustrated in FIG. **8**. Six-bit encoding is very similar to five-bit encoding except that each group and case column provides for more characters so that fewer change-of-group and change-of-case commands are required. This proves to be more efficient than five bit encoding if the message to be transmitted consists of a greater range of characters because there will not be as great a need for changing groups and columns than there would have been in five bit encoding. As illustrated in FIG. **19**, if the message "B>A" is to be transmitted, the five bit encoding would require the following binary bit representations:

Five-Bit Binary Representation	
"B"	00001
">"	11101, 11110, 00011 {change group & case within the group}
"A"	11101, 00000 {change group}
Six-Bit Binary Representation	
"B"	100010
">"	011110
"A"	100001

Thus, for this message the five-bit representation requires 30 bits of data whereas the six bit representation requires 18 bits of data.

Another mode of encoding data is variable-bit-length encoding. One form of variable-bit-length encoding **10** is called Huffman encoding. In Huffman coding characters that are more commonly used are represented by shorter bit lengths than those characters that are less frequently used. The representations will vary according to the language used and the application of the messages. For instance, the American English language would optimally call for different representations than the Italian language. And if the messages to be transmitted are mostly numeric for a particular application, the coding tables could be changed accordingly. Thus, the representations could be varied to satisfy particular needs. An example of Huffman encoding is given in FIG. **9**. Each character representation is set such that each binary sequence identifies a unique character. Thus, a receiver only needs to receive one bit at a time until a character has been uniquely identified. The receiver may continue to receive other binary bits until another character is defined and so on.

FIG. **16** illustrates the operational flow chart of the transmitter sending messages with the above identified encoding methods. Once the transmitter has received a transmission request the transmitter needs to determine if the character set of the message to be transmitted can be defined by four-bit encoding. If so, it will decode the message and begin transmission. Otherwise the transmitter will have to encode the message according to the five, six and variable-bit encoding methods and determine which is the most efficient mode of transmission, i.e. which mode requires the smallest number of binary bits to represent the message.

Once the mode is selected, the transmitter queues the binary-coded data, serializes the binary bits and converts them to four-bit nibbles, each of which may be represented by one of the sixteen DTMF tones. The transmitter then commences transmission of the data by dialing the phone number of the receiver and waiting for a line answer. Once the line is answered the transmitter sends an "A" DTMF tone to signal that it is a transmitter preparing to send a message to the receiver using the tone protocol. The transmitter follows the "A" tone with a DTMF code representation of the encoding mode used by the transmitter as illustrated in FIG. **24**. The receiver is now ready to accept and decode the DTMF signals representative of the message to be delivered.

If the receiver is a paging terminal, the next sequence of DTMF signals will represent the pager identification/access number. This is done by first sending a code representative of the length of the pager identification number so that the paging terminal will know when to stop receiving the pager identification number and when to start receiving the message. Once the pager identification/access number is sent the transmitter will begin to send the encoded message according to FIG. **20**.

The transmitter will send DTMF tones corresponding to the four-bit nibbles representative of the message to be transmitted until all the four-bit nibbles have been transmitted. At the end, there is a possibility that there are fewer than four bits remaining to be sent. If this is the case, the transmitter will simply add zeros as the least significant bits to generate a four-bit nibble and corresponding DTMF tone. The last character the transmitter will transmit is the EOT (end of transmission) character signal of the particular encoding mode followed by an error-checking checksum value. The error checking checksum is a single hex digit calculated according to the following steps:

1. After "A" tone set checksum to zero
2. For each additional digit in the message:
   1) Add the new digit to the new checksum
   2) AND the result with Hex F
   3) multiply the result by 2
   4) if the result is greater then the decimal value 15, subtract 15 from the result.

The receiver, like the transmitter, will have an initial group and case designation. As with the transmitter, the initial group is group 1 and the initial case is upper case. The steps required for the transmitter to receive the encoded messages are illustrated in FIGS. **21** and **22**(*a*) and **22**(*b*). The receiver follows the instructions of the transmitter in decoding the DTMF tones after receiving the initial "A" tone, the pager identification signal and the DTMF tone identifying the encoding method to be used. The receiver receives the encoded message and then compares its checksum value to that sent to the receiver in order to detect errors. If a checksum error is detected the receiver will request the transmitter to resend the message to the receiver. If an error other than the checksum error is detected, e.g. invalid page identification or unsupported data compression technique, the receiver will send one of several pure tones listed in Table 1 to the transmitter. The paging terminal has a limited time to produce a pure tone to the transmitter, e.g., 10 seconds, so that the transmitter will know that there is some error if nothing is received back from the receiver within that time period.

TABLE 1

TONE FREQUENCY	DEFINITION
f1	Page accepted
f2	Checksum error
f3	Page rejected
f4	Unsupported data compression technique utilized
f5	Invalid access number
f6	Alphanumeric message directed to a numeric pager

The receiver's response tone will transmit for a minimum of 250 ms. If there is another message to be transmitted, that "A" tone of the subsequent encoded message is to be received within 5 seconds of the end of the response tone. If the f4 tone is received, the transmitting device is to retransmit the message limiting its selection of a data compression mechanism only to codes 0 through 3 as defined in FIG. **24**. A page rejected tone f3 indicates that the message was received correctly but that the request could not be processed at the present

time. The message should be retransmitted at a later time. The f5 tone indicates that the message was received correctly but that the access or pager identification number is not one of a valid customer. The f6 tone indicates that a alphanumeric message was improperly directed to a pager capable of receiving numerals only. If no response tone is heard within the specified timeout period, the transmitting device can attempt a retransmission of the message. The maximum number of retry attempts is defined by the transmitting device.

FIG. **25** illustrates the steps required for a receiver of the present invention to decode the five-bit encoded message "call" in FIG. **18**. The steps are reversed from those in FIG. **18** and require reception of the DTMF tones, converting the DTMF tones to four-bit nibbles, serializing and regrouping ("queuing") binary bit nibbles into five-bit codes, and looking up in a table the character values for each five-bit binary code until a end of transmission character is found. As in FIG. **18**, FIG. **25** omits depiction of the necessary initial protocols for establishing communication between the transmitter and receiver and the error checking values sent at the end of the message, in order to better explain the coding and decoding techniques of the tone protocol.

The character coding techniques described above could be used in a number of different applications other than as described above. For instance, the 4-bit, 5-bit, 6-bit and variable bit encoding technique described above could be used to communicate characters from the paging terminal **200** to a pager **500** via a radio transmitter **250** as described in FIG. **23**. As described above and shown in FIG. **23**, the character coding methods could be used to communicate messages from the transmitter to the paging terminal over a telephone line with DTMF signals to representing binary bit nibbles. However, the character coding techniques described above could also be used to reduce the transmission time necessary for the paging terminal **200** to communicate messages to a pager.

The paging terminal **200** would only need to communicate the encoded message to a radio transmitter **250** which transmits a radio frequency over the airwaves through an antenna **260**. The radio signals would then be picked up by a remote pager **500** Which would decode the message according to the protocol described above.

The binary bit nibbles would be transmitted to the pager **500** according to a number of different techniques presently known in the art. The method chosen would depend on the carrier frequency and bandwidth available to the user and the effective transmitting range desired by the transmitting body. The transmitting technique chosen would have to be recognized by the pager's receiving antenna **560** and its analog-to-digital decoder **570**. The binary signal could then be simply decoded by a decoding circuit or processor **580** according to the protocol described above. The pager **500** would then display and/or sound a signal to indicate that a signal was received. Depending on the type of pager used, an alphanumeric or numeric message could be displayed on a display **590** and a "beeping" sound could be activated to a small speaker **595**.

One skilled in the art will appreciate that the tone described above, which includes four, five, six and variable-bit encoding could be implemented in any data communication and storage application without straying away from the invention as described herein. There are also very obvious certain slight modifications which could be made in the method described above which would be obvious to one skilled in the art. For instance, communication could still be improved even if DTMF signals were not used. Although DTMF signals are a preferred system of communicating the data between transmitters and receivers, and will be implemented in a protocol system to be marketed under the name "Alpha-Tone" (TM), the protocol could be effectively implemented if the transmitter and receiver were configured to send and receive one bit at a time or by using a DTMF tone with 25 possible outputs rather than the 16 shown herein in order to represent 5 bits per tone rather than the present 4 bits.

Telocator Alphanumeric Protocol

The transmitter of the present invention is also capable of sending messages through the conventional Bell 103 Modem Implementation using the Telocator Alphanumeric Protocol (TM). This TAP standard protocol allows the transmitter to communicate with existing paging terminals which have not implemented the DTMF protocol explained above. The standard for communicating with this protocol is well known in the art and will not be explained in detail herein.

Other Transmitter Functions

As stated above, the transmitter also provides the user with many other functional capabilities. For instance, the transmitter may act as a five-function calculator, a clock, an alarm clock and a timed message reminder. In order to accomplish these functions the transmitter maintains a constant real-time clock for maintaining the proper time and date even when the transmitter is turned off. As represented in FIG. **5**, when the transmitter is initially turned on it is automatically turned on in the calculator mode. At that point the user can simply change the mode of operation of the transmitter by selecting the proper key on the keypad **10** of the transmitter which will command the system controller **40** to change operation of the transmitter.

Once the operation of the transmitter is changed to satisfy the needs of the user, the system controller **40** will either request the necessary information for the selected operation or provide an indication that more information.

The transmitter allows a user to maintain a data file called "Directory" which is a data file allowing the user to store in memory the names of people frequently communicated with, their phone numbers, their paging terminal phone number and type, their pager identification number, their facsimile phone numbers and general information block of data for each person. This makes it possible to enter a functional mode such as fax mode, enter a message and select a destination facsimile machine by simply entering the names of the person(s) whose facsimile machines are to receive the facsimile message. Thus, it will not be necessary for a user to enter a person's facsimile number each time a message is to be transmitted to his or her facsimile machine.

In addition, the user has the option of choosing from a number of "canned" messages stored in memory when selecting a message to be transmitted to a receiver. This saves the user from having to type out frequently used messages. The user may simply select a "canned" message to be inserted into the message being transmitted.

To retain what the user has stored in memory, the transmitter will shut down once it detects the internal battery is low. This will save what is in memory and

allow the user to replace the battery and retain all that is in memory. In addition the transmitter can also be provided with a user password to prevent unauthorized use of the transmitter and its data files.

Although the transmitter and receiver components listed above represent one embodiment of the present invention, it will be appreciated by those skilled in the art that many modifications could be made to the system without modifying from the spirit of the present invention. For instance, the Z8 microcomputer and Z80 microprocessor could easily be replaced with other similar components and the ASIC 12 could be modified to accomplish more of the logic control in the system than is presently shown. In addition, the DTMF protocol herein described could be implemented not only for sending messages to paging terminals but also as a more general data communication technique.

We claim:

1. A portable hand held message transmitter for use in selecting a destination device capable of receiving synthesized waveforms over a switched network from a plurality of destination devices, said portable hand held message transmitter comprising:

input means for receiving alphanumeric characters and commands from a user and for generating signals indicative thereof;

display means for displaying characters indicative of signals provided thereto;

destination selection means responsive to signals generated by the input means for selecting the destination device from said plurality of destination devices, for establishing a transmission path in the switched network, and for determining a data type for the selected destination device, said data type being one of at least two predetermined data types;

message holding means responsive to signals generated by the input means for holding words of binary data indicative of a message from the user, each word associated with a particular character in the message;

waveform synthesis means responsive to the data type being a first one of the at least two predetermined data types, for deriving pixel-map data indicative of rows of the perceived shape of the characters associated with the words of binary data, for producing bit streams indicative of the pixel-map data, and for synthesizing differential phase-shift key waveforms corresponding to the bit streams, whereby the waveforms may be received by a first device type from said plurality of destination devices capable of recognizing said differential phase-shift key waveforms;

said waveform synthesis means further responsive to the data type being a second one of the at least two predetermined data types, for deriving and queuing binary-coded signals associated with the words of binary data, for providing the signals in nibbles composed of fewer bits than the number of bits in the binary-coded signals, and for synthesizing dual-tone multifrequency waveforms indicative of the nibbles, whereby the waveforms may be received by a second device type from said plurality of destination devices which is capable of recognizing said synthesized dual tone multi-frequency waveforms; and

coupling means for coupling said synthesized waveforms to a transmission line.

2. The message transmitter of claim 1 wherein the input means comprises a keyboard.

3. The message transmitter of claim 1 wherein the input means comprises a writing tablet.

4. The message transmitter of claim 1 wherein the nibbles are four bits in length.

5. The message transmitter of claim 4 wherein the higher of the dual tones is selected from one of four predetermined frequencies and wherein the lower of the dual tones is selected from one of four predetermined frequencies.

6. The message transmitter of claim 1 wherein the waveform synthesis means is further responsive to the said data type being a third one of the at least two predetermined data types, for queuing the words of binary data, for generating a serial bit stream of the words of binary data, and for synthesizing frequency-shift keyed signals indicative of the bit stream.

7. A portable hand held message transmitter for use in selecting a destination device from a plurality of destination devices, said selected device capable of receiving synthesized waveforms over a switched network, said portable hand held message transmitter comprising:

input means for receiving alphanumeric characters and commands from a user and for generating signals indicative thereof;

display means for displaying characters indicative of signals provided thereto;

destination selection means responsive to signals generated by the input means for selecting the destination device from among the plurality of destination devices, for establishing a transmission path in the switched network, and for determining a data type for the selected destination device, said data type being one of at least two predetermined data types;

message holding means responsive to signals generated by the input means for holding words of binary data indicative of a message from the user, each word associated with a particular character in the message;

waveform synthesis means responsive to a first one of the at least two predetermined data types, for deriving pixel-map data indicative of rows of the perceived shape of the characters associated with the words of binary data, for producing bit streams indicative of the pixel-map data and for synthesizing differential phase-shift key waveforms corresponding to the bit streams by controlling a differential phase-shift key waveform generator for transmission to a first device type capable of recognizing said differential phase-shift key waveforms,

said differential phase-shift key waveform generator comprising

sinusoidal generation means responsive to a predetermined command generated by the input means for scanning a table having a predetermined number of equally spaced apart entries corresponding to different amplitudes values of a sinusoidal wave with an index pointer, the amplitude of the established signal selected resulting from the scanning of different table entries by the index pointer, thereby generating a sinusoidal carrier frequency,

phase shift means responsive to the contents of the bit stream for changing the index pointer sufficiently to change the phase of the sinusoidal signal delivered to the selected destination;

said waveform synthesis means further responsive to the said data type being a second one of the at least two predetermined data types, for deriving and queuing binary-coded signals associated with the words of binary data, for providing the signals in nibbles composed of fewer bits than the number of bits in the binary-coded signals, and for synthesizing dual-tone multifrequency waveforms indicative of the nibbles, whereby the waveforms may be received by a second device type from said plurality of destination devices, which is capable of recognizing said synthesized dual tone multi-frequency waveforms; and

coupling means for coupling said synthesized waveforms to a transmission line.

8. A portable hand held transmitter as described in claim **7**, wherein the switched network is a public switched telephone network.

9. A portable hand held transmitter as described in claim **7**, wherein the sinusoidal carrier frequency is 1800 Hz.

10. A transmitter for communicating characters comprising:

input means for receiving characters from a user and for generating corresponding binary-coded character signals indicative of the received characters, said character signals comprising a number of bits sufficient to permit a unique signal for each character receivable by the input means;

lookup means with respect to a lookup table having a plurality of rows associated with binary-coded row numbers and two column-pairs associated with a plurality of respective groups, each column-pair comprising two columns each associated with one case of an upper case and a lower case, wherein the intersections of ones of the plurality of rows and ones of the two columns are associated with ones of the character signals, said lookup means responsive to ones of the character signals indicative of the received characters for determining the row and column associated therewith, for determining the binary-coded row number associated with the row, and for determining the case and group associated with the column;

group encoding means having an initial group state and an initial case state, said group encoding means responsive to receipt of an one of the character signals indicative of the received characters for providing the one of the character signals indicative of the received characters to the lookup means and receiving the group and case and binary-coded row number associated with the one of the character signals indicative of the received characters, said group encoding means further responsive to receipt of the group associated with the one of the character signals indicative of the received characters for comparing said group with the previous group state and generating a change-of-group signal in the event of a difference therebetween, said group encoding means further responsive to receipt of the case associated with the one of the character signals indicative of the received characters for comparing said case with the previous case state and generating a change-of-case signal in the event of a difference therebetween, and for generating a row signal associated with the binary-coded row number, the change-of-case and change-of-group signals having the same number of bits as the binary-coded row numbers,

queuing means for receiving and queuing the generated signals and for providing the signals in nibbles composed of fewer bits than the number of bits in the binary-coded row numbers, and

analog means for receiving the nibbles, for producing analog signals indicative thereof, and for coupling said analog signals to a communication channel.

11. The system of claim **10** wherein the input means comprises a keyboard and the communication channel is a transmission line.

12. The system of claim **10** wherein the input means comprises a writing tablet and the communication channel is a transmission line.

13. The system of claim **10** wherein the input means comprises a telephone transmission line and the communication channel is a radio frequency broadcast system.

14. The system of claim **10** wherein the input means comprises a keyboard and the communication channel is a radio frequency broadcast system.

15. The system of claim **10** wherein the nibbles are four bits in length, and wherein the analog signals are dual-tone multifrequency signals.

16. The system of claim **15** wherein the higher of the dual tones is selected from one of four predetermined frequencies and wherein the lower of the dual tones is selected from one of four predetermined frequencies.

17. The system of claim **10** wherein the characters include letters from an alphabet having upper and lower case letters, and wherein the lookup table assigns each pair of corresponding upper and lower case letters to a particular row and to a particular column-pair.

18. The system of claim **10** wherein the characters include letters from the Roman alphabet and the number of bits of the binary-coded row numbers is five.

19. The system of claim **10** wherein the characters include letters from the Roman alphabet and the number of bits of the binary-coded row numbers is six.

20. The system of claim **10** wherein the lookup means, the group encoding means, and the queuing means each comprise a processor and a memory, the processor executing a stored program in the memory, whereby the processor receives characters from the user and provides nibbles to the analog means.

21. The system of claim **20** wherein the nibbles are four bits in length, and wherein the analog signals are dual-tone multifrequency signals, whereby the dual-tone multifrequency signals communicate the characters from the user.

22. The system of claim **21** wherein the higher of the dual tones is selected from one of four predetermined frequencies and wherein the lower of the dual tones is selected from one of four predetermined frequencies.

23. The system of claim **10** wherein the number of bits of the binary-coded row number is four.

24. A transmitter for communicating characters comprising:

input means for receiving characters from a user and for generating corresponding binary-coded character signals indicative of the received characters, said character signals comprising a number of bits sufficient to permit a unique signal for each character receivable by the input means and to be indicative of a character case associated with each of the received characters;

lookup means with respect to a lookup table having a binary bit representation for selected character

signals, wherein the binary bit representation provides relatively shorter unique binary bit representation for frequently used characters and relatively longer binary bit representations for less frequently used characters;

group encoding means having an initial previous character case state, said group encoding means responsive to receipt of an one of the character signals indicative of the received characters for providing the one of the character signals indicative of the received characters to the lookup means and receiving the binary bit representation associated with the one of the character signals indicative of the received characters, said group encoding means further responsive to receipt of the binary bit representation associated with the one of the character signals indicative of the received characters for comparing the character case of the character signals indicative of the received characters with the previous character case state of the group encoding means and generating a change-of-case signal and an update previous character case state signal in the event of a different therebetween,

queuing means for receiving and queuing the generated binary bit representations and for providing the representations in nibbles composed of different number bits than the number of bits in the Huffman binary bit representation, and

analog means for receiving the nibbles, for producing analog signals indicative thereof, and for coupling said analog signals to a communication channel.

25. The system of claim **24** wherein the input means comprises a keyboard and the communication channel is a transmission line.

26. The system of claim **24** wherein the input means comprises a writing tablet and the communication channel is a transmission line.

27. The system of claim **24** wherein the input means comprises a telephone transmission line and the communication channel is a radio frequency broadcast system.

28. The system of claim **24** wherein input means comprises a keyboard and the communication channel is a radio frequency broadcast system.

29. The system of claim **24** wherein the nibbles are four bits in length, and wherein the analog signals are dual-tone multifrequency signals.

30. The system of claim **29** wherein the higher of the dual tones is selected from one of four predetermined frequencies and wherein the lower of the dual tones is selected from one of four predetermined frequencies.

31. The system of claim **24** wherein the characters include letters from an alphabet having upper and lower case letters.

32. The system of claim **24** wherein the characters include letters from the Roman alphabet and the number of bits of the Huffman representation varies from two to twenty-two.

33. The system of claim **24** wherein the lookup means, the group encoding means, and the queuing means each comprise a processor and a memory, the processor executing a stored program in the memory, whereby the processor receives characters from the user and provides nibbles to the analog means.

34. The system of claim **33** wherein the nibbles are four bits in length, and wherein the analog signals are dual-tone multifrequency signals, whereby the dual-tone multifrequency signals communicate the characters from the user.

35. The system of claim **34** wherein the higher of the dual tones is selected from one of four predetermined frequencies and wherein the lower of the dual tones is selected from one of four predetermined frequencies.

36. A portable hand held transmitter for communicating characters according to one of a plurality of encoding schemes, said transmitter comprising:

input means for receiving characters from a user and for generating corresponding binary-coded signals indicative of the received characters, said binary-coded character signals comprising a number of bits sufficient to permit a unique signal for each character receivable by the input means;

lookup means for generating at least one corresponding binary bit representation for each of the binary-coded character signals generated by the input means, said lookup means including a lookup table including a plurality of binary bit representations for a select group of characters receivable by the input means wherein one of said plurality of binary bit representations includes a four bit binary representation for each of the select group of characters receivable by the input means

group encoding means responsive to receipt of the binary coded character signals from the input means for determining which of the plurality of encoding schemes to transmit the received characters from the input means, for providing the received binary coded character signals to the lookup means and for receiving the corresponding binary bit representations from the lookup means for the binary coded character signals received; and

analog means for receiving the binary bit representations from the group encoding means, for producing analog signals indicative thereof, and for coupling said analog signals to a communication channel.

37. The system of claim **36** wherein the input means comprises a keyboard and the communication channel is a transmission line.

38. The system of claim **36** wherein the input means comprises a writing tablet and the communication channel is a transmission line.

39. The system of claim **36** wherein the input means comprises a telephone transmission line and the communication channel is a radio frequency broadcast system.

40. The system of claim **36** wherein the input means comprises a keyboard and the communication channel is a radio frequency broadcast system.

41. A portable hand held message transmitter for use in selecting a destination device from a plurality of destination devices, said selected device are capable of receiving synthesized waveforms over a switched network, said portable hand held message transmitter comprising:

input means for receiving alphanumeric characters and commands from a user and for generating signals indicative thereof;

display means for displaying characters indicative of signals provided thereto;

destination selection means responsive to signals generated by the input means for selecting the destination device from said plurality of destination devices, for establishing a transmission path in the switched network, and for determining a data type for the selected destination device, said data type being one of at least two predetermined data types;

message holding means responsive to signals generated by the input means for holding words of binary data indicative of a message from the user, each word associated with a particular character in the message;

waveform synthesis means responsive to the data type being a first one of the at least two predetermined data types, for deriving pixel-map data indicative of rows of the perceived shape of the characters associated with the words of binary data, for producing bit streams indicative of the pixel-map data, and for synthesizing differential phase-shift key waveforms corresponding to the bit streams, whereby the waveforms may be received by a first device type capable of recognizing said differential phase-shift key waveforms;

said waveform synthesis means further responsive to the said data type being a second one of the at least two predetermined data types, for queuing the words of binary data, for generating a serial bit stream of the words of binary data, and for synthesizing frequency-shift keyed signals indicative of the bit stream whereby the waveforms may be received by a second device type which is capable of recognizing said synthesized frequency-shift keyed signals; and

coupling means for coupling said synthesized waveforms to a transmission line.

42. The message transmitter of claim **41** wherein the input means comprises a keyboard.

43. The message transmitter of claim **41** wherein the input means comprises a writing tablet.

44. A portable message transmitter for use in selecting a destination device from a plurality of destination devices, said selected device capable of receiving synthesized waveforms over a switched network, said portable hand held message transmitter comprising:

input means for receiving alphanumeric characters and commands from a user and for generating signals indicative thereof;

display means for displaying characters indicative of signals provided thereto;

destination selection means responsive to signals generated by the input means for selecting the destination device from among a plurality of destination devices, for establishing a transmission path in the switched network, and for determining a data type for the selected destination, said data type being one of at least two predetermined data types;

message holding means responsive to signals generated by the input means for holding words of binary data indicative of a message from the user, each word associated with a particular character in the message;

waveform synthesis means responsive to the data type being a first one of the at least two predetermined data types, said waveform synthesis means responsive to the destination selection means for deriving pixel-map data indicative of rows of the perceived shape of the characters associated with the words of binary data, for producing bit streams indicative of the pixel-map data, and for synthesizing differential phase-shift key waveforms corresponding to the bit streams by controlling a differential phase-shift key waveform generator, said differential phase-shift key waveform generator comprising

sinusoidal generation means responsive to a predetermined command generated by the input means for scanning a table having a predetermined number of equally spaced apart entries corresponding to different amplitudes values of a sinusoidal wave with an index pointer, the amplitude of the established signal selected resulting from the scanning of different table entries by the index pointer, thereby generating a sinusoidal carrier frequency,

phase shift means responsive to the contents of the bit stream for changing the index pointer sufficiently to change the phase of the sinusoidal signal delivered to the selected destination; and

coupling means for coupling said synthesized waveforms to a transmission line,

whereby the waveforms may be received a first device type from said plurality of destination devices capable of recognizing said differential phase-shift key waveforms;

said waveform synthesis means further responsive to the said data type being a second one of the at least two predetermined data types, for queuing the words of binary data, for generating a serial bit stream of the words of binary data, and for synthesizing frequency-shift keyed signals indicative of the bit stream; and

coupling means for coupling said synthesized waveforms to a transmission line.

45. A message receiver for receiving alphanumeric characters from message transmitter over a communication channel, said message transmitter providing analog output signals representing nibbles of a binary representation of characters in an alphanumeric message, said message receiver comprising:

input means responsive to reception of analog signals from the message transmitter for receiving the analog signals over the communication channel and for converting the analog signals to binary bit nibbles;

queuing means responsive to reception of the binary bit nibbles for queuing the binary bit nibbles as a serial binary bit stream and for converting the serial binary bit stream to binary coded row numbers, each of the binary coded row numbers comprising a predetermined number of bits from said serial binary bit stream;

lookup means having an initial case state and an initial group state with respect to a lookup table having a plurality of rows associated with binary-coded row numbers and two column-pairs associated with a plurality of respective groups, each column-pair comprising two columns each associated with one case of an upper case and a lower case, wherein the intersections of ones of the plurality of rows and ones to the two columns are associated with ones of character signals in a preselected case of a preselected group, said lookup means responsive to the receipt of a binary coded row number for selecting the intersection of the row associated with the binary coded row number and said preselected case of said preselected group, said preselected case of said preselected group initially corresponding to the initial case state and initial group state, said lookup means further responsive to the receipt of a change-case signal from the selected intersection for changing the preselected case for subsequent selection of intersections, said lookup means fur-

ther responsive to receipt of a change-group signal from the selected intersection for changing the preselected group for subsequent selection of intersections; and

character output means responsive to the receipt a character signal from the intersection of selected rows and columns in the lookup means for converting said character signals to user accessible representations.

46. The message receiver of claim **45** wherein the communication channel is a switched network and the message receiver is a message receiving host.

47. The message receiver of claim **45** wherein the communication channel is a radio frequency broadcast system and the message receiver is a portable battery powered device.

48. The message receiver of claim **45** wherein the binary coded row number comprises 5 bits.

49. The message receiver of claim **45** wherein the binary coded row number comprises 6 bits.

50. The message receiver of claim **45** wherein the binary coded row numbers may be one of at least two predetermined bit lengths and wherein said input means further comprises a binary row bit length decoding means responsive to the reception of said binary bit nibbles for determining the binary bit length of the binary coded row numbers.

51. The message receiver of claim **45** further characterized in that each of the binary bit nibbles is provided by the message transmitter as a respective analog dual-tone multifrequency tone, and wherein the message receiver converts each of said respective analog dual-tone multifrequency tones to the respective binary bit nibble.

52. The message receiver of claim **45** further characterizes in that each of the binary bit nibbles is provided by the message transmitter as a serial sequence of a plurality of analog signals each representative of a corresponding bit of the binary bit nibble, and wherein the message receiver converts each such analog dual-tone to the respective binary bit nibble.

53. The message receiver of claim **45** wherein the binary-coded row numbers comprises 4 bits.

54. A message receiver for receiving alphanumeric characters from message transmitter over a communication channel, said message transmitter providing analog output signals representing nibbles of a binary representation of characters in an alphanumeric message, said message receiver comprising:

input means responsive to reception of analog signals from the message transmitter for receiving the analog signals over the communication channel and for converting the analog signals to binary bit nibbles;

queuing means responsive to reception of the binary bit nibbles for queuing the binary bit nibbles as a serial binary bit stream;

lookup means with respect to a plurality of lookup tables having binary bit representations for respective selected character signals, wherein the binary bit representation in at least one of said plurality of lookup tables provides relatively shorter unique binary bit representation for frequently used characters and relatively longer binary bit representations for less frequently used characters, the binary bit representation being no shorter than a predetermined shortest length and no longer than a predetermined greatest length, said lookup means comprising means to receive binary bit nibbles from the queuing means for selecting one of the plurality of lookup tables for evaluating a series of binary bit data and for receiving a sequence of binary bit nibbles of a length corresponding to the shortest unique binary bit representation within the selected one of the plurality of lookup tables, said lookup means further comprising first means for determining whether the sequence of bits matches that of one of the binary bit representation of a length equal to that of the sequence of bits within the selected lookup table, and for generating the character signal corresponding to the matching bit representation, said lookup means further comprising second means responsive to the absence of a match and the selection of one of the plurality of lookup tables which provides for relatively shorter unique binary bit representation for frequently used characters and relatively longer binary bit representation for less frequently used characters for receiving from the queuing means and for appending at least one additional bit to the sequence of bits, said sequence of bits being provided to the first means; and

character output means responsive to the receipt of a character signal from the lookup mans for converting said character signals to user accessible representations.

55. The message receiver of claim **54** wherein the communication channel is a switched network and the message receiver is a message receiving host.

56. The message receiver of claim **54** wherein the communication channel is a radio frequency broadcast system and the message receiver is a portable battery powered device.

57. The message receiver of claim **54** further characterized in that each of the binary bit nibbles is provided by the message transmitter as a respective analog dual-tone multifrequency tone, and wherein the message receiver converts each such analog dual-tone multifrequency tone to the respective binary bit nibble.

58. The message receiver of claim **54** further characterizes in that each of the binary bit nibbles is provided by the message transmitter as a serial sequence of a plurality of analog signals each representative of a corresponding bit of the binary bit nibble, and wherein the message receiving host converts each such analog dual-tone to the respective binary bit nibble.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,249,220

DATED : September 28, 1993

INVENTOR(S) : Moskowitz et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 13, line 15, "encoding 10" should read --encoding--.

Column 15, line 44,, "Which" should read --which--.

Column 24, line 31, "from" should read --from a--.

Column 26, line 36, "mans" should read --means--.

Column 1, line 63, "character" should read --characters--.

Column 6, line 50, "also" should read --also be--.

Column 8, line 48, "above jack" should read --telephone jack--.

Column 11, line 43, "ship" should read --skip--.

Column 14, line 22, "then" should read --than--.

Column 15, line 5, "a" should read --an--.

Column 15, line 35, "to representing" should read --representing--.

Column 16, lines 44-45, "more information" should read -- more information is needed--.

Column 18, line 59, "amplitudes" should read --amplitude--.

Column 21, line 41, "wherein" should read --wherein the--.

Column 22, line 53, "are" should read --being--.

Column 24, line 5, "amplitudes" should read --amplitude--;

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,249,220

DATED : September 28, 1993

INVENTOR(S) : Moskowitz et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 24, line 17, "received" should read --received by--.

Column 25, line 5, "receipt" should read --receipt of--.

Column 25, lines 35-36, "characterizes" should read --characterized--.

Column 25, line 43, "comprises" should read --comprise--.

Column 26, line 20, "representation" should read --representations--.

Column 26, line 52-53, "characterizes" should read --characterized--.

Signed and Sealed this

Twenty-third Day of August, 1994

Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

US 20010049289A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2001/0049289 A1

Kim (43) Pub. Date: Dec. 6, 2001

(54) METHOD OF TRANSMITTING AND RECEIVING GRAPHIC SHORT MESSAGE SERVICE MESSAGES IN A PORTABLE RADIO TERMINAL

(75) Inventor: Hoe-Won Kim, Namweon-shi (KR)

Correspondence Address:
Paul J. Farrell, Esq.
Dilworth & Barrese, LLP
333 Earle Ovington Blvd.
Uniondale, NY 11553 (US)

(73) Assignee: SAMSUNG ELECTRONICS CO., LTD., KYUNGKI-DO (KR)

(21) Appl. No.: 09/854,616

(22) Filed: May 14, 2001

(30) Foreign Application Priority Data

May 31, 2000 (KR) 2000-29543

Publication Classification

(51) Int. Cl.[7] H04Q 7/20

(52) U.S. Cl. 455/466; 455/566; 455/414

(57) ABSTRACT

A method of transmitting and receiving graphic data by an SMS message is disclosed. To transmit a graphic SMS message, graphic SMS messages are registered, a portable radio terminal is changed over to a graphic SMS message selection mode upon receipt of an SMS message editing key signal, a graphic SMS message is selected among the registered graphic SMS messages, and the graphic data of the selected graphic SMS message is edited and transmitted.

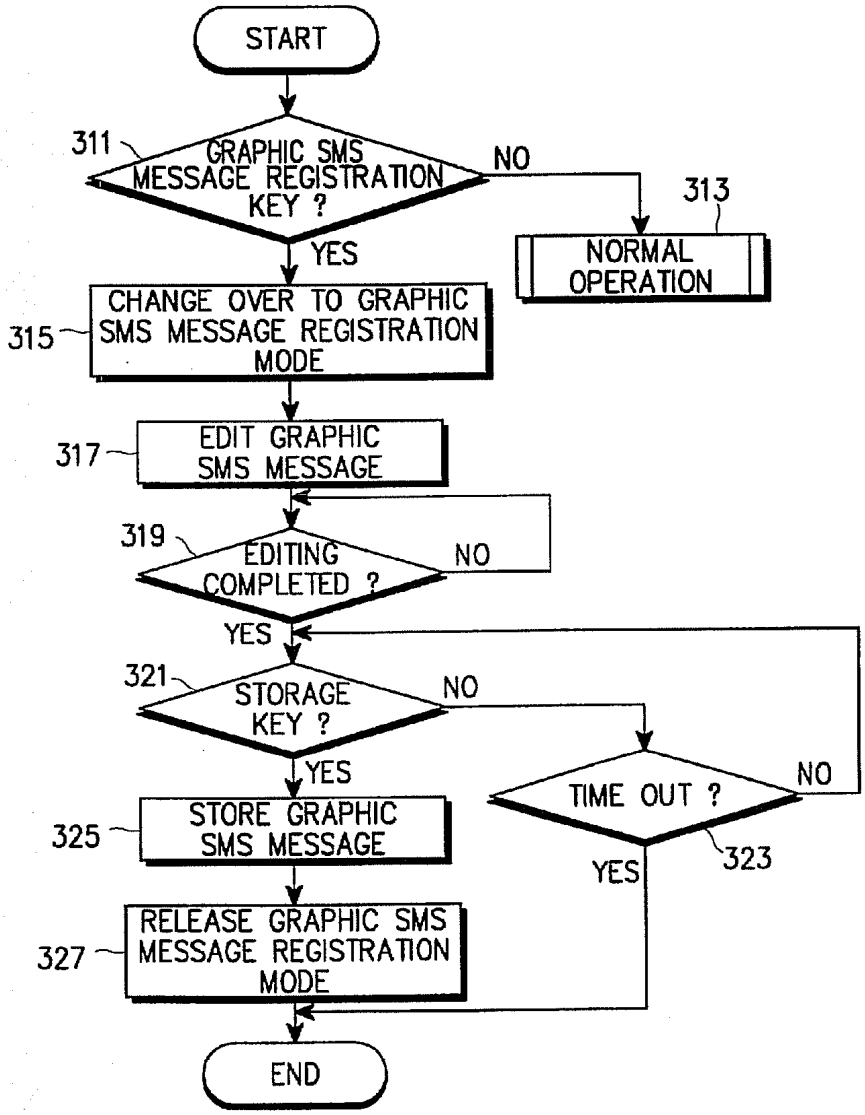
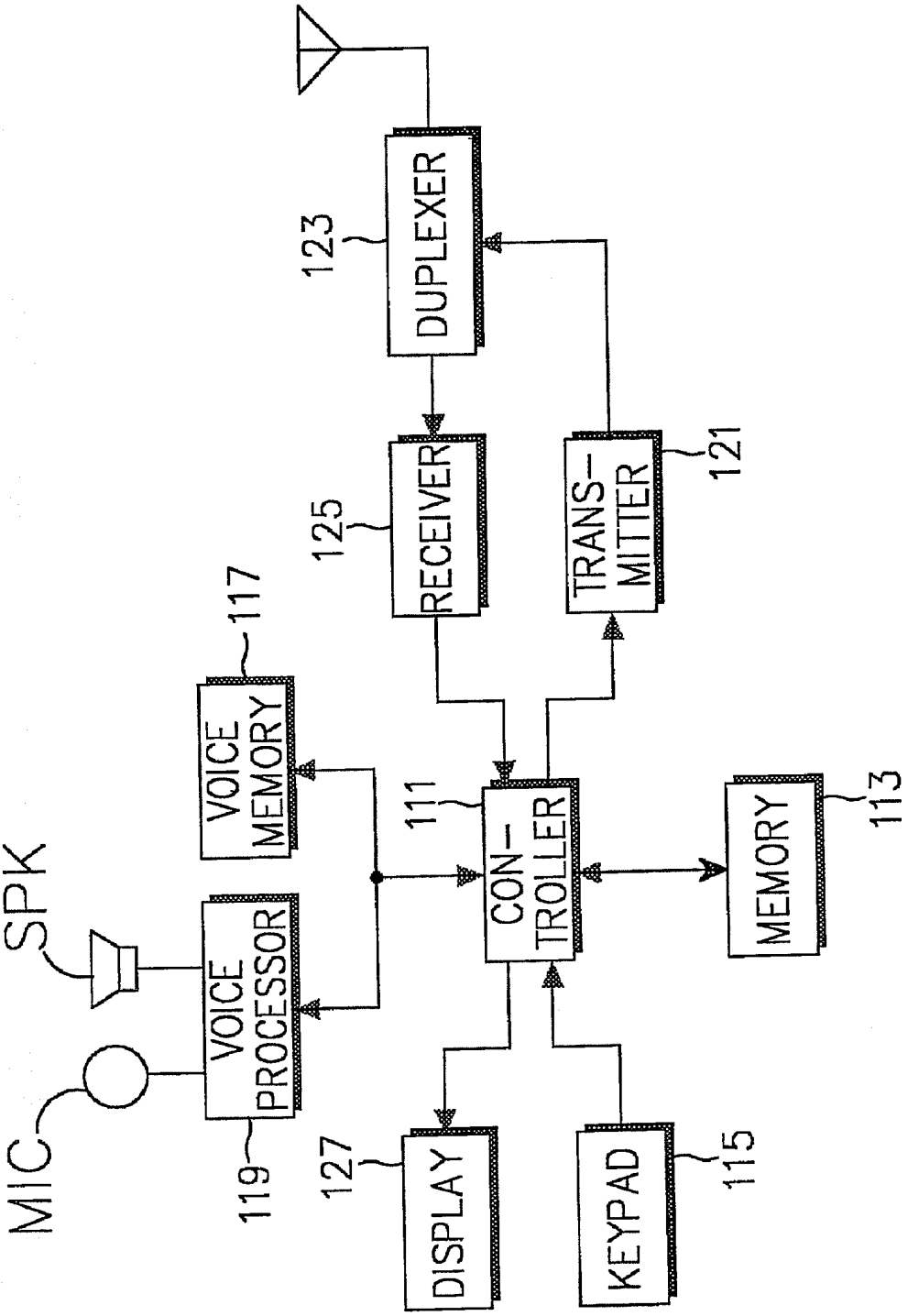


FIG. 1


SPK
MIC
VOICE PROCESSOR
119
VOICE MEMORY
117
111
CON-TROLLER
MEMORY
113
DISPLAY
127
KEYPAD
115
RECEIVER
125
TRANS-MITTER
121
DUPLEXER
123

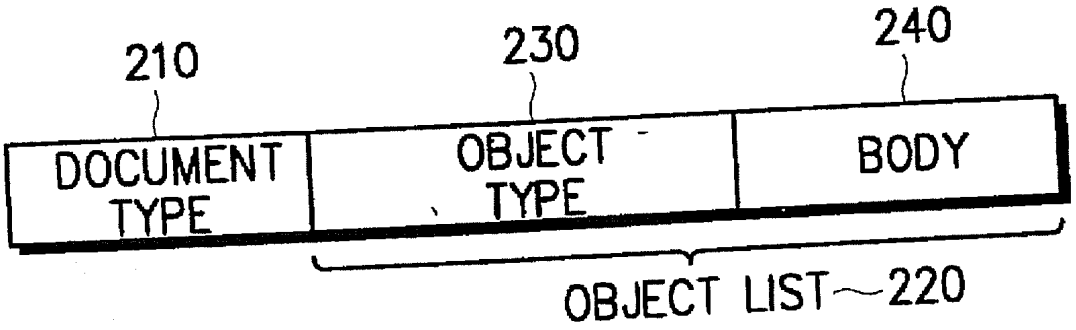


FIG. 2

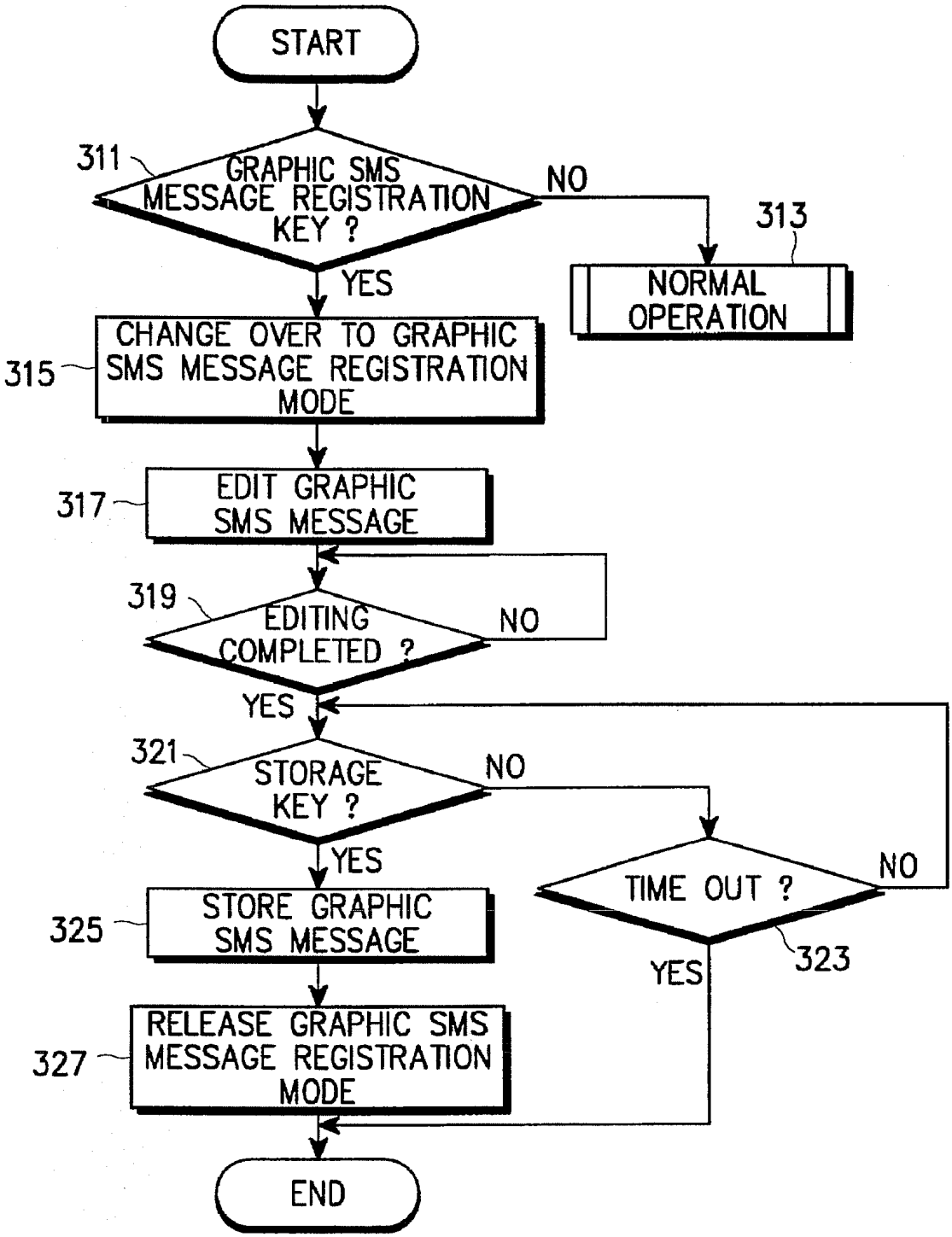

START
311
GRAPHIC SMS MESSAGE REGISTRATION KEY ?
NO
313
NORMAL OPERATION
YES
315
CHANGE OVER TO GRAPHIC SMS MESSAGE REGISTRATION MODE
317
EDIT GRAPHIC SMS MESSAGE
319
EDITING COMPLETED ?
NO
YES
321
STORAGE KEY ?
NO
YES
TIME OUT ?
NO
YES
323
325
STORE GRAPHIC SMS MESSAGE
327
RELEASE GRAPHIC SMS MESSAGE REGISTRATION MODE
END

FIG. 3

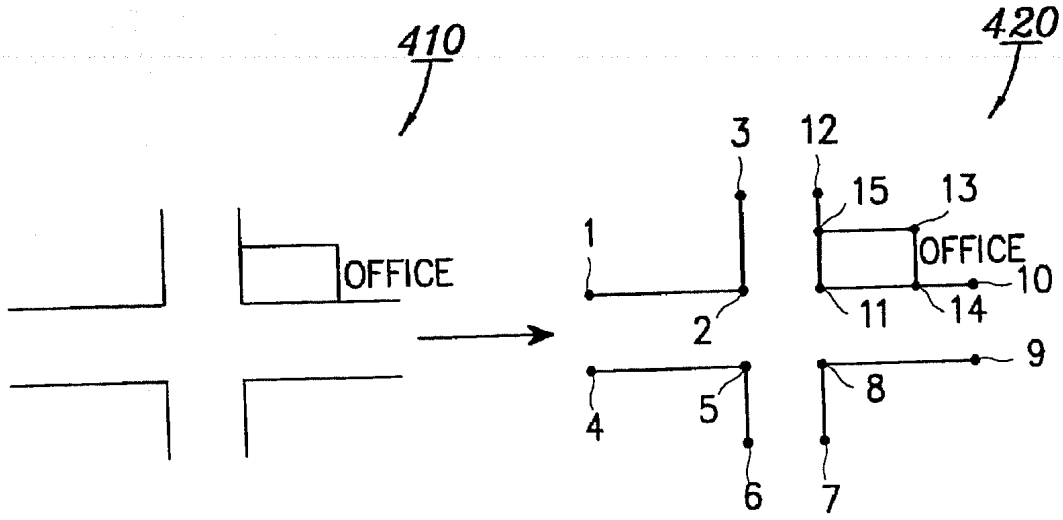


FIG. 4

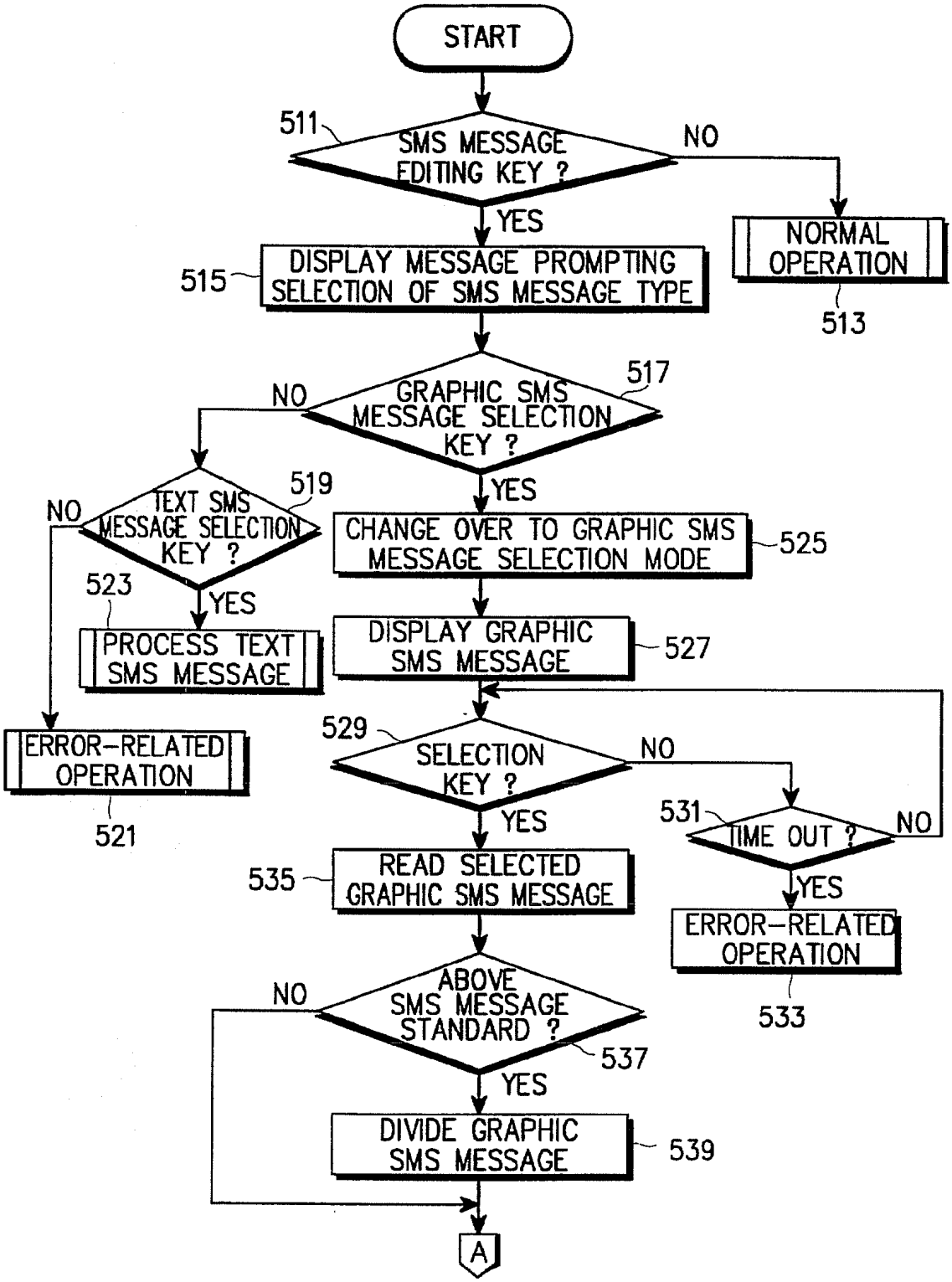

START
511
SMS MESSAGE EDITING KEY ?
NO
YES
NORMAL OPERATION
513
515
DISPLAY MESSAGE PROMPTING SELECTION OF SMS MESSAGE TYPE
517
GRAPHIC SMS MESSAGE SELECTION KEY ?
NO
YES
519
TEXT SMS MESSAGE SELECTION KEY ?
NO
YES
523
PROCESS TEXT SMS MESSAGE
CHANGE OVER TO GRAPHIC SMS MESSAGE SELECTION MODE
525
DISPLAY GRAPHIC SMS MESSAGE
527
ERROR-RELATED OPERATION
521
529
SELECTION KEY ?
NO
YES
531
TIME OUT ?
NO
YES
ERROR-RELATED OPERATION
533
535
READ SELECTED GRAPHIC SMS MESSAGE
ABOVE SMS MESSAGE STANDARD ?
NO
537
YES
DIVIDE GRAPHIC SMS MESSAGE
539
A

FIG. 5

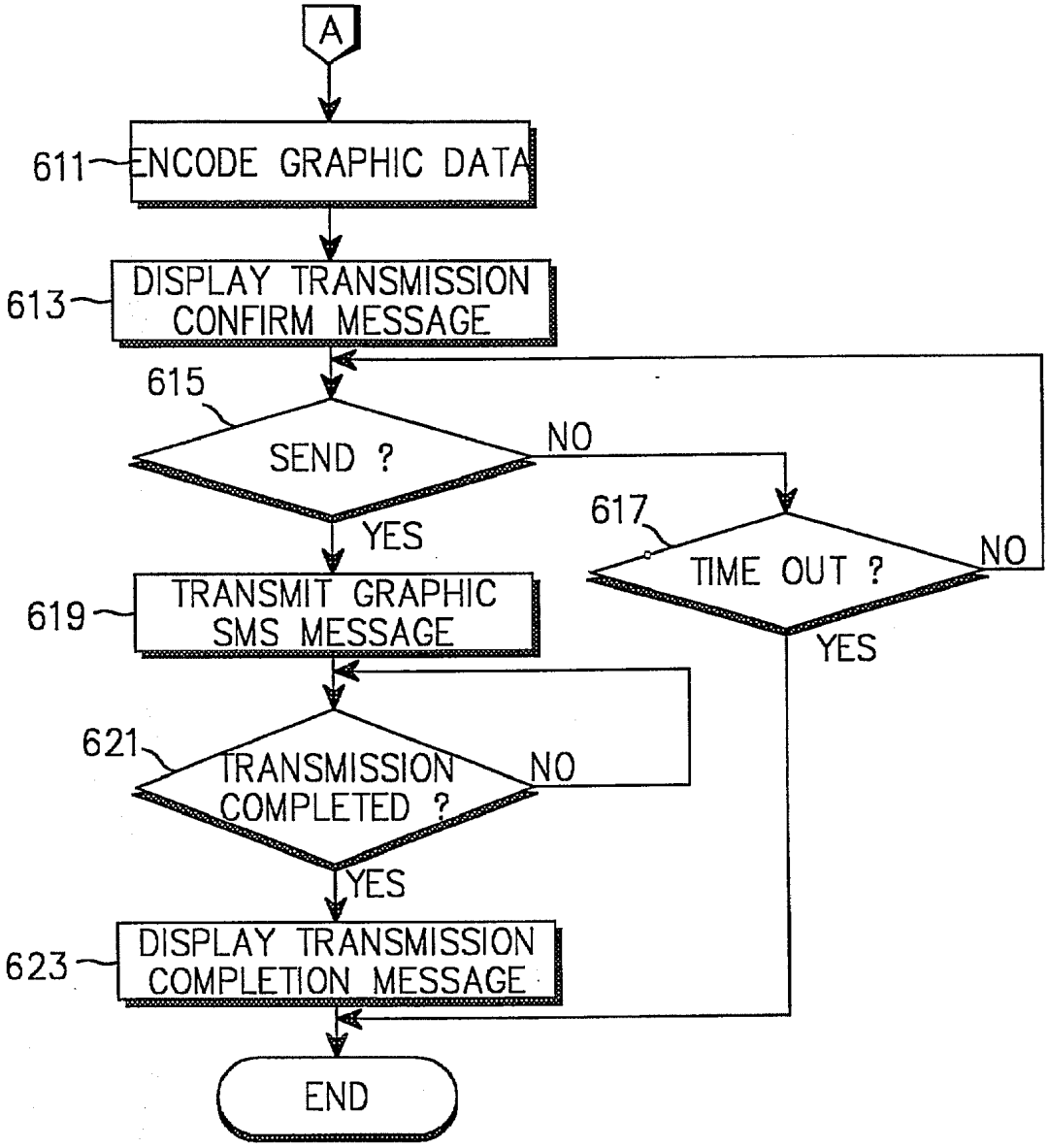

A
611
ENCODE GRAPHIC DATA
613
DISPLAY TRANSMISSION CONFIRM MESSAGE
615
SEND ?
NO
YES
617
TIME OUT ?
NO
YES
619
TRANSMIT GRAPHIC SMS MESSAGE
621
TRANSMISSION COMPLETED ?
NO
YES
623
DISPLAY TRANSMISSION COMPLETION MESSAGE
END

FIG. 6

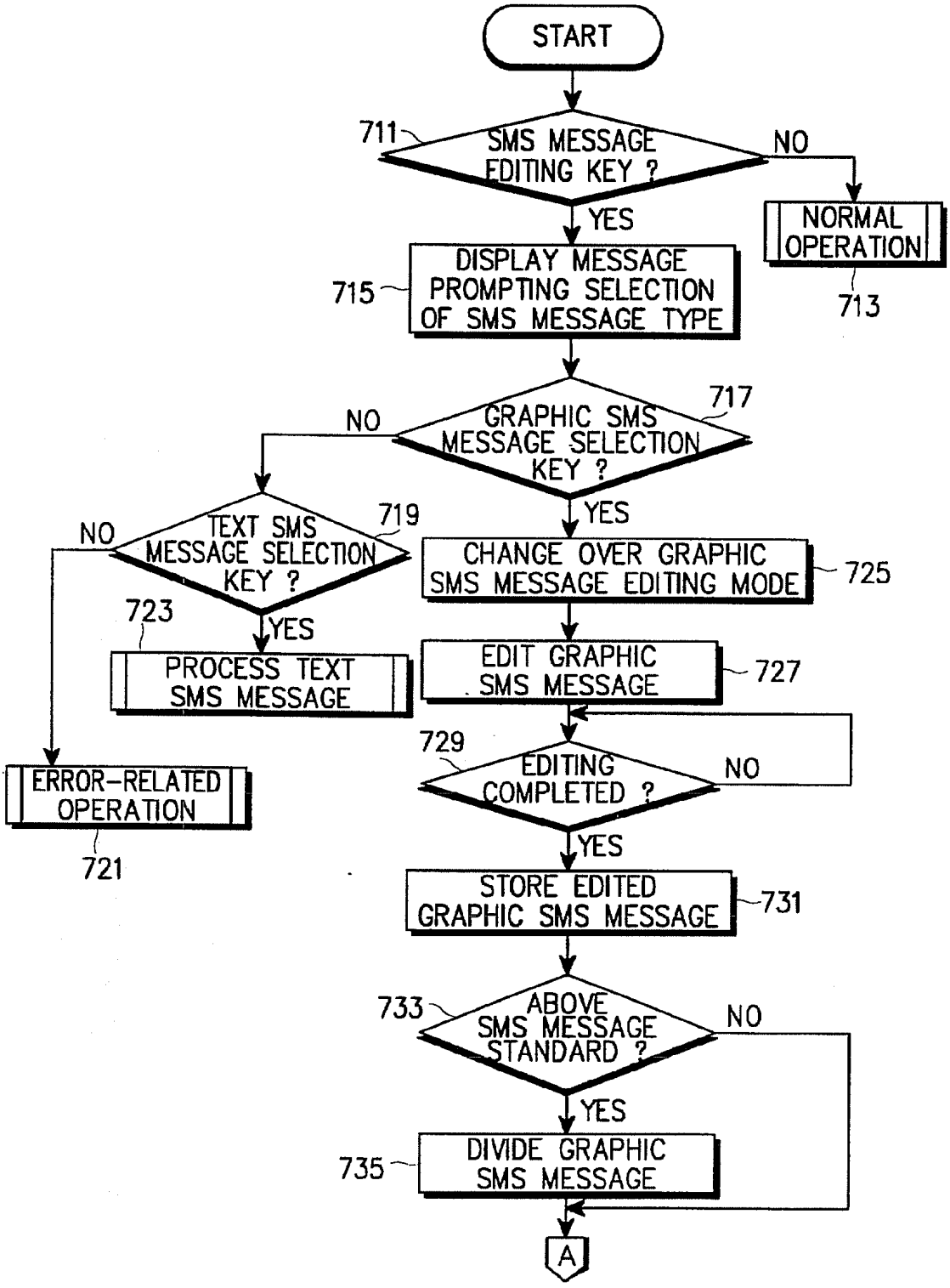

START
711
SMS MESSAGE EDITING KEY ?
NO
YES
NORMAL OPERATION
713
715
DISPLAY MESSAGE PROMPTING SELECTION OF SMS MESSAGE TYPE
717
GRAPHIC SMS MESSAGE SELECTION KEY ?
NO
YES
719
TEXT SMS MESSAGE SELECTION KEY ?
NO
YES
723
PROCESS TEXT SMS MESSAGE
CHANGE OVER GRAPHIC SMS MESSAGE EDITING MODE
725
EDIT GRAPHIC SMS MESSAGE
727
729
EDITING COMPLETED ?
NO
YES
ERROR-RELATED OPERATION
721
STORE EDITED GRAPHIC SMS MESSAGE
731
733
ABOVE SMS MESSAGE STANDARD ?
NO
YES
735
DIVIDE GRAPHIC SMS MESSAGE
A

FIG. 7

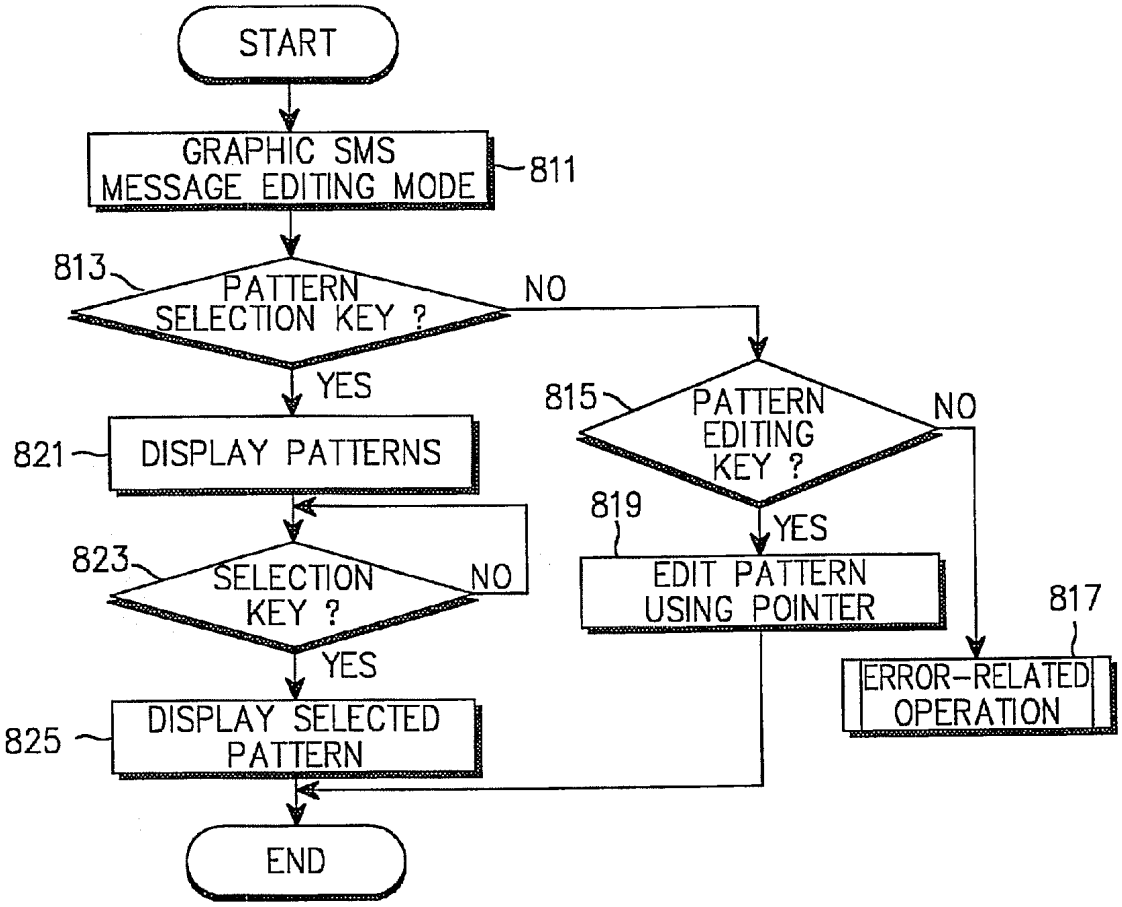

START
GRAPHIC SMS MESSAGE EDITING MODE
811
813
PATTERN SELECTION KEY ?
NO
YES
815
PATTERN EDITING KEY ?
NO
821
DISPLAY PATTERNS
819
YES
823
SELECTION KEY ?
NO
EDIT PATTERN USING POINTER
817
YES
ERROR-RELATED OPERATION
825
DISPLAY SELECTED PATTERN
END

FIG. 8

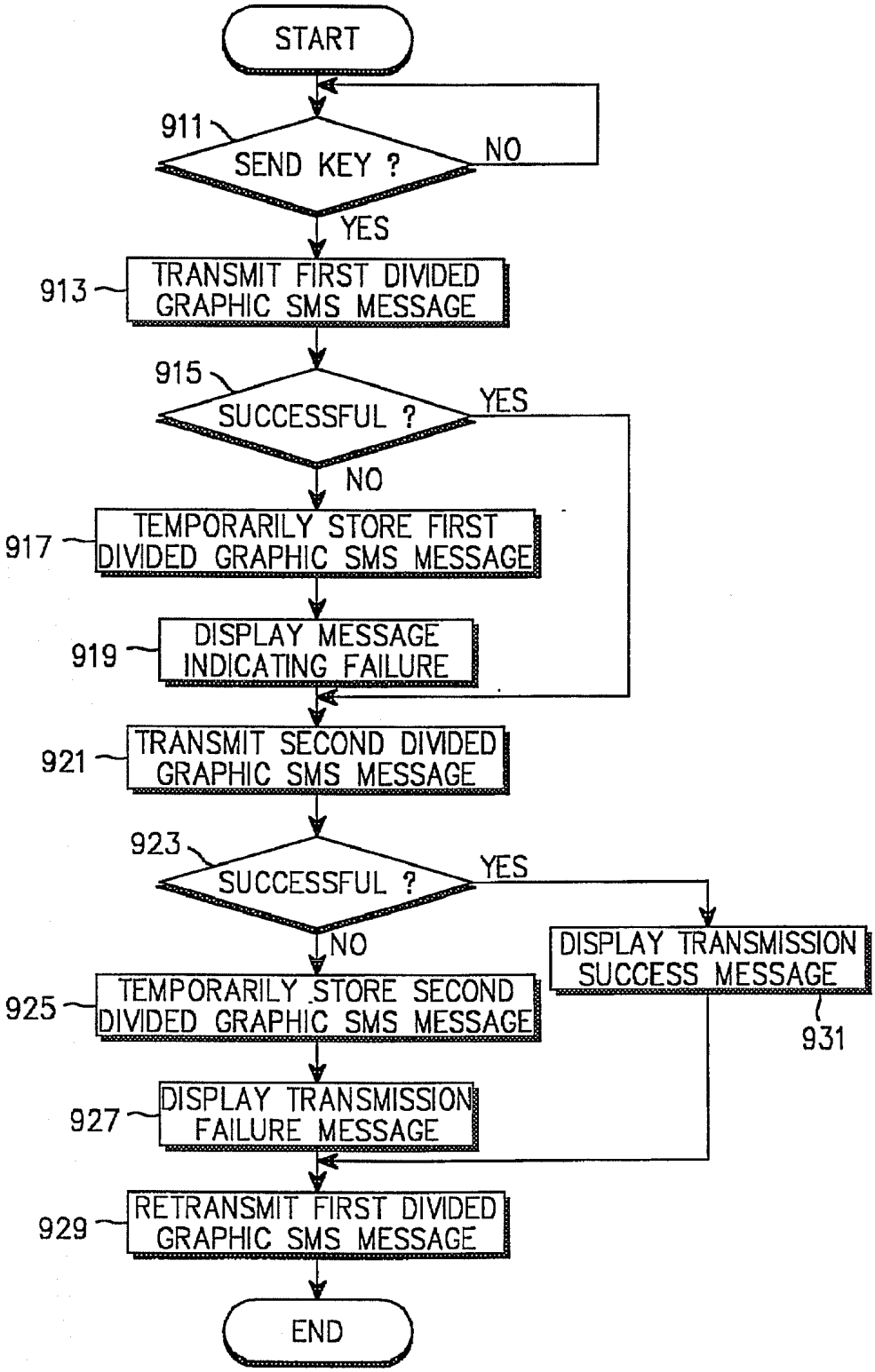

START
911
SEND KEY ?
NO
YES
913
TRANSMIT FIRST DIVIDED GRAPHIC SMS MESSAGE
915
SUCCESSFUL ?
YES
NO
917
TEMPORARILY STORE FIRST DIVIDED GRAPHIC SMS MESSAGE
919
DISPLAY MESSAGE INDICATING FAILURE
921
TRANSMIT SECOND DIVIDED GRAPHIC SMS MESSAGE
923
SUCCESSFUL ?
YES
NO
925
TEMPORARILY STORE SECOND DIVIDED GRAPHIC SMS MESSAGE
927
DISPLAY TRANSMISSION FAILURE MESSAGE
DISPLAY TRANSMISSION SUCCESS MESSAGE
931
929
RETRANSMIT FIRST DIVIDED GRAPHIC SMS MESSAGE
END

FIG. 9

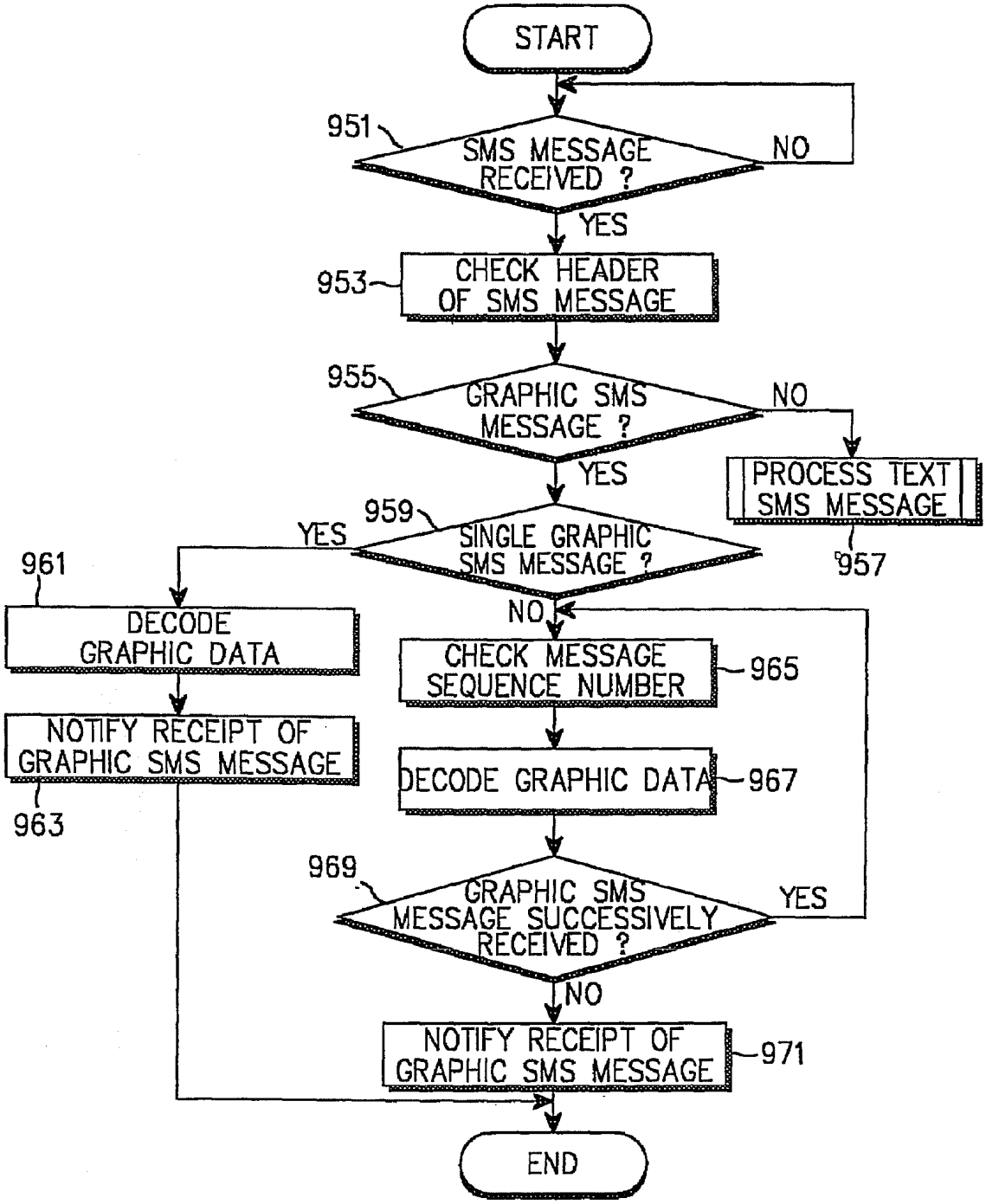

START
951
SMS MESSAGE RECEIVED ?
NO
YES
953
CHECK HEADER OF SMS MESSAGE
955
GRAPHIC SMS MESSAGE ?
NO
YES
PROCESS TEXT SMS MESSAGE
957
959
SINGLE GRAPHIC SMS MESSAGE ?
YES
NO
961
DECODE GRAPHIC DATA
NOTIFY RECEIPT OF GRAPHIC SMS MESSAGE
963
CHECK MESSAGE SEQUENCE NUMBER
965
DECODE GRAPHIC DATA
967
969
GRAPHIC SMS MESSAGE SUCCESSIVELY RECEIVED ?
YES
NO
NOTIFY RECEIPT OF GRAPHIC SMS MESSAGE
971
END

FIG. 10

METHOD OF TRANSMITTING AND RECEIVING GRAPHIC SHORT MESSAGE SERVICE MESSAGES IN A PORTABLE RADIO TERMINAL

PRIORITY

[0001] This application claims priority to an application entitled "Method of Transmitting and Receiving Graphic Short Message Service Message in Portable Radio Terminal" filed in the Korean Industrial Property Office on May 31, 2000 and assigned Ser. No. 2000-29543, the contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates generally to a portable radio terminal system, and in particular, to a method of transmitting and receiving graphic data by a short message service (SMS) message.

[0004] 2. Description of the Related Art

[0005] In general, an SMS as well as a call service are provided to a portable radio terminal. The SMS allows a caller to leave a message in a text message regardless of the state of a called portable radio terminal, even when the called terminal is busy, thereby increasing user convenience.

[0006] Since the SMS is limited to text messages, however, a user may feel inconvenienced when he would rather transmit graphic data, such as a map, than transmit it in a text message to indicate a geographical location.

SUMMARY OF THE INVENTION

[0007] It is, therefore, an object of the present invention to provide a method of transmitting and receiving graphic data by an SMS message in a portable radio terminal.

[0008] To achieve the above object, a method of transmitting and receiving graphic data by an SMS message is provided. In the graphic SMS message transmitting method of the present invention, graphic SMS messages are registered, a portable radio terminal is switched over to a graphic SMS message selection mode upon receipt of an SMS message editing key signal, a graphic SMS message is selected among the registered graphic SMS messages, and the graphic data of the selected graphic SMS message is edited and transmitted.

[0009] In the present graphic SMS message receiving method, the header of an SMS message is checked upon receipt of the SMS message, it is determined whether the SMS message is a single graphic SMS message, the sequence number of the graphic SMS message is detected if the SMS message is not a single graphic SMS message, the data of the graphic SMS message is decoded according to the sequence number, and upon receipt of another graphic SMS message successively, the above steps are repeated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

[0011] **FIG. 1** is a block diagram of a portable radio terminal to which the present invention is applied;

[0012] **FIG. 2** illustrates an embodiment of an SMS message format according to the present invention;

[0013] **FIG. 3** is a flowchart illustrating an embodiment of a graphic SMS message registering procedure according to the present invention;

[0014] **FIG. 4** illustrates an example of an image edited according to an embodiment of the present invention;

[0015] **FIGS. 5 and 6** are flowcharts illustrating an embodiment of a graphic SMS message transmitting procedure according to the present invention;

[0016] **FIG. 7** is a flowchart illustrating another embodiment of the graphic SMS message transmitting procedure according to the present invention;

[0017] **FIG. 8** is a flowchart illustrating an embodiment of a graphic SMS message editing procedure according to the present invention;

[0018] **FIG. 9** is a detailed flowchart illustrating the transmission operation shown in **FIG. 6**; and

[0019] **FIG. 10** is a flowchart illustrating an embodiment of a graphic SMS message receiving procedure according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] Preferred embodiments of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

[0021] **FIG. 1** is a block diagram of a portable radio terminal to which the present invention is applied. Referring to **FIG. 1, a** controller **111** provides overall control to the portable radio terminal. A memory **113** stores a control program and control data generated during the control operation of the controller **111**.

[0022] A keypad **115** has a plurality of dialing digit keys and function keys such as MENU, SEND, and END, for generating a key signal corresponding to a key selected by a user and feeding the key signal to the controller **111**.

[0023] A voice memory **117** stores a plurality of voice messages. A voice processor **119** processes a voice message read from the voice memory **117** to an analog voice signal and outputs the analog voice signal via a speaker. The voice processor **119** also processes an analog voice signal received from the user via a microphone to a digital signal.

[0024] A transmitter **121** modulates a signal received from the controller **111** to a digital radio signal and transmits the modulated signal to a duplexer **123**. The duplexer **123** transmits the radio signal received from the transmitter **121** via an antenna and a signal received from the antenna to a receiver **125**. The receiver **125** demodulates the radio signal received from the duplexer **123** and the controller **111** controls the call according to the demodulated signal received from the receiver **125**.

[0025] A display **127** includes an LCD (Liquid Crystal Display) and an LED (Light Emitting Diode) and displays control data and input data under the control of the controller **111**.

[0026] **FIG. 2** illustrates an embodiment of an SMS message format according to the present invention. An SMS supports a fixed amount of text data in a typical portable radio terminal. For example, the European GSM (Global System for Mobile Communications) supports only **160** text characters. According to the present invention, due to the fixed SMS standard, an SMS message is identified as text data or graphic data according to DOCUMENT TYPE **210** in its header. DOCUMENT TYPE **210** is a one-byte flag that discriminates between text data and graphic data according to its pattern.

[0027] OBJECT LIST **220** following DOCUMENT TYPE **210** is divided into OBJECT TYPE **230** and BODY **240**, and includes real SMS data. OBJECT TYPE **230** indicates what the SMS data represents among a line, a curved line, a polygon, and text. BODY **240** provides the coordinates list of graphic data if OBJECT TYPE **230** indicates graphic data and provides text data if OBJECT TYPE **230** indicates text data.

[0028] **FIG. 3** is a flowchart illustrating an embodiment of a graphic SMS message registering procedure according to the present invention and **FIG. 4** illustrates an example of an image edited according to an embodiment of the present invention.

[0029] Referring to **FIG. 3**, upon receipt of a key signal from the keypad **115**, the controller **111** determines whether the key signal was generated from a graphic SMS message registration key in step **311**. If the key signal was generated from any other key, the controller **111** performs a normal operation with respect to the received key signal in step **313**.

[0030] In the case of the graphic SMS message registration key, the controller **111** changes over the portable radio terminal to a graphic SMS message registration mode in step **315** and edits a graphic SMS message based on key signals received from the keypad **115** in step **317**. The graphic SMS message may be edited in many ways. For example, a specific key may be set using a plurality of keys in combination in the keypad **115** and used as a kind of pointer to form a line by connecting a start point to an end point.

[0031] The editing step **317** will be described referring to **FIG. 4**.

[0032] If a user wants to send graphic data **410**, a graphic SMS message **420** is edited using a plurality of straight lines **1-2**, **2-3**, **4-5**, **5-6**, **7-8**, **8-9**, **10-11**, **11-12**, **13-14**, and **13-15** in the portable radio terminal. Here, straight line editing is performed by Haffman coding. A total of 20 bytes are assigned to the 10 straight lines, 2 bytes given to each straight line. 1 byte is assigned to each character and thus 6 bytes to the word "office". 1 byte is assigned to the header DOCUMENT TYPE **210**.

[0033] A straight line is edited by connecting a start point to an end point using a specific key, for example, using a scroll key as a pointer in a graphic data editing mode. The start point and the end point each are presented in coordinates and the coordinates list is transmitted as real data in the graphic SMS message.

[0034] Upon receipt of a signal corresponding to the key END from the keypad **115**, the controller **111** determines that the editing has been completed in step **319** and checks whether a storage key signal has been received from the keypad **115** in step **321**. If the storage key signal was not received, the controller **111** checks whether a predetermined time (e.g., 5 seconds) has elapsed in step **323**. If the predetermined time does not expire, the controller **111** returns to step **321**. After the predetermined time, the controller **111** ends the procedure.

[0035] Upon receipt of the storage key signal in step **321**, the controller **111** stores the edited graphic SMS message in the memory **113** in step **325** and releases the graphic SMS message registration mode in step **327**. If a plurality of graphic SMS messages are edited and registered, they are given sequence numbers, for identification. Then, the procedure ends.

[0036] **FIGS. 5 and 6** are flowcharts illustrating an embodiment of a graphic SMS message transmitting procedure according to the present invention. Referring to **FIGS. 5 and 6**, the controller **111** checks whether an SMS message editing key signal has been received in step **511**. If the SMS message editing key signal was not received, the controller **111** performs a normal operation with respect to the key signal in step **513**.

[0037] Upon receipt of the SMS message editing key signal in step **511**, the controller **111** reads a message prompting a user to choose an SMS message type between a graphic SMS message and a text SMS message from the memory **113** and displays the read message on the display **127** in step **515**. The message may be given as a text message such as "select SMS message type" or as an icon image representing a key set by combining a plurality of keys in the keypad **115**.

[0038] If a graphic SMS message selection key signal is received in step **517**, the controller **111** changes over the portable radio terminal to a graphic SMS message selection mode in step **525**. In the graphic SMS message selection mode, a graphic SMS message is selected among those registered in the memory **113**. In step **527**, the controller **111** reads a graphic selection message, for example, "enter selected number" from the memory **113** and displays the graphic selection message as an icon image on the display **127**. The controller **111** checks whether a selection key signal has been received from the keypad **115** in step **529**. If the selection key signal was not received, the controller **111** determines whether a predetermined time (e.g., 5 seconds) has elapsed in step **531**. If the predetermined time has elapsed, the controller **111** regards the process that has been done so far as an error and performs a related operation in step **533**.

[0039] Upon receipt of the selection key signal in step **529**, the controller **111** reads a graphic SMS message with a sequence number corresponding to the selection key signal from the memory **113** in step **535** and checks whether the data amount of the selected graphic SMS message exceeds the SMS message standard, that is, the maximum data amount of a single text SMS message allowed for one transmission in step **537**. If the graphic SMS message exceeds the SMS message standard, the controller **111** divides the graphic SMS message into a plurality of segments according to the SMS message standard in step **539**.

In this case, each graphic SMS message segment is formatted into a graphic SMS message with DOCUMENT TYPE **210** indicating its segmentation from the original graphic SMS message and its sequence number in the original SMS message.

[0040] In step **611**, the controller **111** encodes each graphic SMS message segment, for example, by Haffman coding. The controller **111** reads a transmission confirm message asking whether the graphic SMS message will be transmitted, for example, "Send?" from the memory **113** and displays it on the display **127** in step **613**. In step **615**, the controller **111** checks whether a SEND key signal has been received from the keypad **115**. If the SEND key signal was not received, the controller **111** determines whether a predetermined time, say, 5 seconds has elapsed in step **617**. If the predetermined time does not expire, the controller **111** returns to step **615**. If the predetermined time expires, the controller **111** ends the procedure.

[0041] On the other hand, if the SEND key signal was received from the keypad **115** in step **615**, the controller **111** sends the graphic SMS message in step **619** and checks whether the transmission is completed in step **621**. If the transmission is completed, the controller **111** reads a transmission completion message, for example, "Completed" from the memory **113** and displays it on the display **127** in step **623**.

[0042] **FIG. 7** is a flowchart illustrating another embodiment of the graphic SMS message transmitting procedure according to the present invention. Referring to **FIG. 7**, the controller **111** checks whether an SMS message editing key signal has been received in step **711**. If the SMS message editing key signal was not received, the controller **111** performs a normal operation with respect to the key signal in step **713**.

[0043] Upon receipt of the SMS message editing key signal in step **711**, the controller **111** reads a message prompting the user to choose an SMS message type between a graphic SMS message and a text SMS message from the memory **113** and displays the message on the display **127** in step **715**. The message may be displayed as a text message such as "select SMS message type" or as an icon image representing a key set by combining a plurality of keys in the keypad **115**.

[0044] If a graphic SMS message selection key signal is not received in step **717**, the controller **111** checks whether a text SMS message selection key signal is received in step **719**. If the text SMS message selection key signal is not received in step **719**, the controller **111** regards the process that has been done so far as an error and performs a related operation in step **721**. Upon receipt of the text SMS message selection key signal in step **719**, the controller **111** performs a normal text SMS message editing and transmission operation in step **723**.

[0045] Upon receipt of the graphic SMS message selection key signal in step **717**, the controller **111** changes over the portable radio terminal to a graphic SMS message editing mode in step **725**. In step **727**, the controller **111** edits a user-selected graphic SMS message received from the keypad **115**. The graphic SMS message may be edited in many ways. For example, a specific key is set using a plurality of keys in combination in the keypad **115** and used as a kind of pointer to form a line by connecting a start point to an end point. Or upon receipt of a specific key, selectable patterns are read from the memory **113** and displayed on the display **127**, so that the user selects one of them. Upon receipt of an editing completion signal in step **729**, the controller **111** temporarily stores the edited graphic SMS message in the memory **113** in step **731** and checks whether the edited graphic SMS message exceeds the SMS message standard, that is, the maximum data amount of a single text SMS message allowed for one transmission in step **733**. If the graphic SMS message exceeds the SMS message standard, the controller **111** divides the graphic SMS message into a plurality of segments according to the SMS message standard in step **735** and goes to step **611** of **FIG. 6**.

[0046] **FIG. 8** is a flowchart illustrating an embodiment of a graphic SMS message editing procedure according to the present invention. Referring to **FIG. 8**, after the controller **111** changes over the portable mobile terminal to an SMS message editing mode in step **811**, it checks whether a pattern selection key signal has been received in step **813**. If the pattern selection key signal was not received, the controller **111** checks whether a pattern editing key signal has been received in step **815**. If the pattern editing key signal was not received, the controller **111** regards the process that has been performed so far as an error and performs a related operation in step **817**.

[0047] Upon receipt of the pattern editing key signal in step **815**, the controller **111** edits a pattern using a specific key in the keypad **115** as a pointer in the manner described in context with step **317** of **FIG. 3** in step **819**.

[0048] Upon receipt of the pattern selection key signal in step **813**, the controller **111** reads selectable patterns from the memory **113** and displays them on the display **127** in step **821**. The selectable patterns were registered in advance in the memory **113**, such as a rectangle, a triangle, and so on.

[0049] In step **823**, the controller **111** checks whether a selection key signal has been received from the keypad **115**. Upon receipt of the selection key signal, the controller **111** displays a pattern corresponding to the selection key signal on the display **127** in step **825**.

[0050] **FIG. 9** is a flowchart illustrating the procedure of transmitting graphic SMS message segments shown in **FIG. 6** in detail. Here, it is assumed that a graphic SMS message is divided into two segments.

[0051] Referring to **FIG. 9**, upon receipt of a SEND key signal from the keypad **115**, the controller **111** transmits a first graphic SMS message in step **913** and checks whether the transmission is successful in step **915**. If the transmission has failed, the controller **111** temporarily stores the failed first graphic SMS message in the memory **113** in step **917**. Then, the controller **111** reads a transmission failure message such as "Failed" from the memory **113** and displays it on the display **127** in step **919**. If, at step **915** transmission was successful, the process proceeds to step **921**.

[0052] In step **921**, the controller **111** transmits a second graphic SMS message. The controller **111** checks whether the transmission is successful in step **923**. If the transmission has failed, the controller **111** temporarily stores the failed second graphic SMS message in the memory **113** in step **925**. Then, the controller **111** reads a transmission failure

message such as "Failed" from the memory **113** and displays it on the display **127** in step **927**.

[**0053**] On the other hand, if the second graphic SMS message was successfully transmitted in step **923**, the controller **111** reads a transmission success message such as "Successful" from the memory **113** and displays it on the display **127** in step **931**. In step **929**, the controller **111** reads the failed first graphic SMS message from the memory **113** and retransmits it.

[**0054**] **FIG. 10** is a flowchart illustrating an embodiment of a graphic SMS message receiving procedure according to the present invention. Referring to **FIG. 10**, upon receipt of an SMS message in step **951**, the controller **111** detects the header DOCUMENT TYPE of the received SMS message in step **953** and checks whether the SMS message is a graphic SMS message based on DOCUMENT TYPE in step **955**. If the SMS message is not a graphic SMS message, the controller **111** performs a normal text SMS message process in step **957**.

[**0055**] In the case of a graphic SMS message, the controller **111** determines whether the graphic SMS message is a single one based on DOCUMENT TYPE in step **959**. If the graphic SMS message is a single one, the controller **111** decodes the received graphic data in step **961** and notifies the user of receipt of the graphic SMS message by displaying it in the form of an icon image on the display **127** or sounding an alarm in step **963**.

[**0056**] If the graphic SMS message is not a single one, the controller **111** detects a message sequence number from DOCUMENT TYPE in step **965**. The controller **111** decodes the graphic SMS message according to its message sequence number in step **967** and checks whether another graphic SMS message has been received successively in step **969**. Upon successive receipt of the next graphic SMS message, the controller **111** returns to step **965**. If another graphic SMS message is not received successively, the controller **111** notifies the user of receipt of the graphic SMS message in step **971**.

[**0057**] In accordance with the present invention as described above, a graphic SMS message as well as a text SMS message can be transmitted by an SMS in a portable radio terminal. Therefore, a user message is transmitted more effectively and more conveniently.

[**0058**] Furthermore, a graphic SMS message can be transmitted utilizing a conventional SMS simply by modifying the MMI (Man Machine Interface) of the portable radio terminal. Consequently, the use efficiency of radio resources in a mobile communication system is increased.

[**0059**] While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A method of transmitting a graphic SMS (Short Message Service) message in a portable radio terminal, comprising the steps of:

registering graphic SMS messages for transmission;

switching the portable radio terminal to a graphic SMS message selection mode upon receipt of an SMS message editing key signal;

receiving a graphic SMS message selected among the registered graphic SMS messages;

encoding graphic data of the selected graphic SMS message; and

transmitting the encoded graphic data.

2. The method of claim 1, wherein the registration step comprises the steps of:

switching the portable radio terminal to a graphic SMS message registration mode upon receipt of a graphic SMS registration key signal;

editing the graphic SMS message using a pointer in the graphic SMS message registration mode; and

registering the edited graphic SMS message upon receipt of a storage key signal.

3. The method of claim 1, wherein the graphic SMS message includes:

a header indicating whether an SMS message is a text type or an graphic data type;

a first area indicating whether the SMS message is presented as a straight line, a curved line, a polygon, or a text; and

a second area that provides a coordinates list of graphic data if the SMS message is the graphic data type and provides text data if the SMS message is the text type.

4. The method of claim 1, wherein the graphic data is encoded by Haffman coding.

5. A method of transmitting a graphic SMS message in a portable radio terminal, comprising the steps of:

prompting a user to choose an SMS message type between a graphic SMS message and a text SMS message upon receipt of an SMS message editing key signal;

switching the portable radio terminal to a graphic SMS message editing mode if the graphic SMS message is selected as the SMS message type to be transmitted;

editing the graphic SMS message to be transmitted in the graphic SMS message editing mode;

encoding the edited graphic SMS message if the editing is completed; and

transmitting the encoded graphic SMS message.

6. The method of claim 5, further comprising the steps of editing a text SMS message to be transmitted and transmitting the edited text SMS message if the text SMS message is selected as the SMS message type to be transmitted.

7. The method of claim 5, wherein a specific key is set using a plurality of keys of the portable radio terminal in combination and a line is formed by connecting a start point to an end point using the specific key as a pointer in the graphic SMS message editing step.

8. The method of claim 5, wherein the graphic SMS message editing step comprises:

displaying pre-registered selectable patterns upon receipt of a pattern selection key signal;

selecting one of the selectable patterns; and

displaying the selected pattern.

9. The method of claim 5, wherein the graphic SMS message includes:

a header indicating whether an SMS message is a text type or an graphic data type;

a first area indicating whether the SMS message is presented as a straight line, a curved line, a polygon, or a text; and

a second area that provides a coordinates list of graphic data if the SMS message is the graphic data type and provides text data if the SMS message is the text type.

10. The method of claim 5, wherein the graphic data is encoded by Haffman coding.

11. The method of claim 9, further comprising the steps of:

determining whether a data amount of the edited graphic SMS message exceeds an SMS message standard length;

dividing the graphic SMS message into a plurality of segments according to the SMS message standard length if the data amount of the edited graphic SMS message exceeds the SMS message standard length;

encoding the graphic SMS message segments; and

sequentially transmitting the encoded graphic SMS message segments.

12. The method of claim 11, wherein the sequential transmission step comprises:

sequentially transmitting the graphic SMS message segments in an order of a higher priority with respect to the headers of the graphic SMS message segments;

completing the sequential transmission procedure if a transmission-failed graphic SMS message segment exists; and

retransmitting the transmission-failed graphic SMS message segment.

13. The method of claim 11, wherein a specific key is set using a plurality of keys of the portable radio terminal in combination and a line is formed by connecting a start point to an end point using the specific key as a pointer in the graphic SMS message editing step.

14. A method of receiving a graphic SMS message in a portable radio terminal, comprising the steps of:

(1) checking a header of an SMS message upon receipt of the SMS message;

(2) determining whether the SMS message is a single graphic SMS message;

(3) detecting a sequence number of the graphic SMS message if the SMS message is not a single graphic SMS message;

(4) decoding data of the graphic SMS message according to the sequence number; and

(5) returning to step (3) upon receipt of a successive graphic SMS message.

15. The method of claim 14, further comprising the step of processing a text SMS message if the received SMS message is the text SMS message by checking the header of the SMS message.

16. The method of claim 14, further comprising the steps of:

decoding the data of the graphic SMS message if the received SMS message is a single graphic SMS message; and

providing notification that the graphic SMS message has been received.

17. A method of transmitting a graphic SMS message in a portable radio terminal, comprising the steps of:

switching the portable radio terminal to a graphic SMS message editing mode upon request of transmission of the graphic SMS message;

editing the graphic SMS message to be transmitted in the graphic SMS message editing mode; and

dividing the edited graphic SMS message into a plurality of segments to an SMS message standard length if a data amount of the edited graphic SMS message exceeds an SMS message standard length.

18. The method of claim 17, wherein preregistered graphic data is selected or graphic data is received using a pointer in the graphic SMS message editing step.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/091,311	03/04/2002	Diego Kaplan	UTL 00134	8151

7590 05/02/2007

Kyocera Wirless Corp., Attn: Patent Department
PO Box 928289
San Diego, CA 92192-8289

EXAMINER	
TRUONG, LAN DAI T	

ART UNIT	PAPER NUMBER
2152	

MAIL DATE	DELIVERY MODE
05/02/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/091,311	KAPLAN, DIEGO	
	Examiner	Art Unit	
	Lan-Dai Thi Truong	2152	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 February 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *11-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 March 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This action is response to communications: application, filed on 03/04/2002; amendment filed 02/07/2007. Claims 11-30 are pending; claims 11-17, 19-25, 28-30 are amended

2. The applicant's arguments file on 09/07/2006 have fully considered; but they are moot in view with new ground for rejections

Response to Arguments

3. Applicant's arguments filed 02/07/2007have been fully considered; but Applicant's arguments are not persuasive as flowing reasons

4. Regarding Applicant's arguments with respect to the cited references do not disclose selecting the format prior to encoding the SMS message are not persuasive; Moskowitz clearly discloses this claimed feature, i.e. method for selecting a fewest number of binary bits character encode format for encoding message; although Moskowitz does not explicitly disclose step of the format selected prior encoding message; however it would have been obvious in the art to know that prior message encoding process implementing, encoding format should be selected, see (Moskowitz: column 12, lines 1-10; column 13, lines 40-46; column 3, lines 1-50)

5. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., ...responsive

to SMS message character encoding requirements...) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993)

6. In response to applicant's argument that the Mathai fails to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., character encoding...) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993)

7. In response to applicant's arguments that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., selecting the SMS character encoding format based on a wireless device resource requirement of the encoded SMS message...) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993); However, the Moskowitz also discloses this claimed features, i.e. Moskowitz discloses steps of testing and evaluating encoding message in different kinds of "numbers of bits character encoding formats" which shares functionality with "resource requirement of the encoded message"; and then the fewest binary bit character encoding format is selected for encoding transmitting message, see (Moskowitz: figures 14-19; column 3, lines 1-50; column 12, lines 1-10, lines 15-40; column 13, lines 40-45; column 7, lines 60-67; column 11, lines 67)

Claim rejections-35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 11-17 are rejected under 35 U.S.C 103(a) as being un-patentable over Lee (U.S. 6,590,887) in view of Moskowitz et al (U.S. 5,249,220)

Regarding claim 11:

Lee discloses the invention substantially as claimed, including a system, which can be implemented in a computer hardware or software code for optimal Short Message Service (SMS) encoding in a wireless communications device having SMS capabilities, the system comprising:

Character encoding subsystem with input to accept the SMS message and an output to supply the SMS message in a character encoding format: (Lee disclose method for creating and transmitting encoded SMS from a digital mobile communication terminal with a SMS function. In the Lee's digital mobile communication terminal, " an encoder/decoder" which shares functionality with "character encoding subsystem" as claimed, which implements SMS encoding process on received generated SMS message from PCS and then transmits encoded SMS into network: column 2, lines 38-43)

However, Lee does not explicitly disclose an optimizing subsystem which accepts n message, accepts evaluation control signal and supplies an optimizing signal responsive to message character encoding requirements prior to character encoding the message

In analogous art, Moskowitz discloses a method for generating encoded alphanumer message in the fewest binary bits character encoding format for transmitting over wireless network; Moskowitz's system contains numbers of available different character encoding formats those are represented by numbers of binary bits. The binary bit character encoding formats are evaluated in order to select the fewest binary bit character encoding format for encoding transmitting message; it would have been obvious in the art to know that prior message encoding process implementing, encoding format should be selected: figures 14-19; column 3, lines 1-50; column 12, lines 1-10, lines 15-40; column 13, lines 40-45; column 7, lines 60-67; column 11, lines 67)

Thus, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine Moskowitz's ideas of using selected the fewest binary bits character encoding format for encoding alphanumer message into Lee's system in order to be able to employ a well-know standard with Lee's system for saving resource and development time and also to be able to reducing memory/bandwidth consumption, see (Moskowitz: column 2, lines 1-37)

Regarding claim 12:

In addition to rejection in claim 11, Lee- Moskowitz further discloses identifying character encoding format parameters including the number of bits needed to represent characters: (Moskowitz discloses encoding format must be identified while evaluating and

selecting encoding format such as five bits, six bits …ect. the smallest number of binary bits is chose to represent the message: column 12, lines 1-9; column 13, lines 34-45)

Regarding claim 13:

In addition to rejection in claim 12, Lee- Moskowitz further discloses method of determining a memory usage requirement, selects as the optimal encoding format with a minimum memory usage, and wherein the optimizing subsystem supplies the identity of the optimal encoding format in the optimizing signal: (Moskowitz discloses the encoding format is determined such as five bits, six bits …ect. the smallest number of binary bits is chose to represent the message: (column 12, lines 1-9; column 13, lines 34-45)

Regarding claim 14:

This claim is rejected under rationale of claim 11

Regarding claim 15:

In addition to rejection in claim 14, Lee- Moskowitz further discloses a memory circuit has an input to accept the encoded SMS message for storage and an output to supply the stored SMS message: (Lee discloses RAM and ROM to store predefined messages. The message read from the memory and displays on the display: column 1, lines 42-45, lines 22-45; column 3, lines 25-52)

Regarding claim 17:

In addition to rejection in claim 15, Lee- Moskowitz further discloses wherein the user interface has an input to accepts the stored message for presentation: (Moskowitz: figure 4)

Regarding claim 16:

In addition to rejection in claim 15, Lee- Moskowitz further includes transceiver: (Moskowitz: figure 1, item 50)

Claim 18 is rejected under 35 U.S.C 103(a) as being un-patentable over Lee-Moskowitz in view of Wolf et al. (U.S. 5,844,922)

Regarding claim 18:

Lee- Moskowitz discloses the invention substantially as disclosed in claim 15, but does not explicitly teach seven-bit ASCII as a default optimal encoding format

In analogous art, Wolf discloses a constraint length of 7 is typical in encoding format, see (Wolf: column 1, lines 44-46; column 2, lines 3-12; column 3, lines 15-30; column 13, lines 63-64).

Thus, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine Wolf's ideas of using constraint length of 7 is typical as encoding format into Lee- Moskowitz's system in order to be able to employ a well-know standard with Lee's system for saving resource and development time

Claims 19-21, 23-24 and 28-30 are rejected under 35 U.S.C 103(a) as being un-patentable Kim (U.S. 2001/0049289) in view of Moskowitz et al (U.S. 5,249,220)

Regarding claim 19:

Kim discloses the invention substantially as claimed, including a method, which can be implemented in a computer hardware or software code for encoding a Short Message Service (SMS) message, the method comprising:

Encoding SMS message using a character SMS encoding format to generate an encoded message: (Kim discloses method for generating encoded SMS message for transmitting over the network; Kim's encoding MSM system inherently includes character MSM encoding format; also it would have been obvious in the art to know that prior encoding process implementation, encoding format should be selected: [0026]; [0029]-[0032]; [0040]; claim 1)

However, Kim does not explicitly disclose selecting the character encoding format based on a wireless device resource requirement of the encoded message: (Moskowitz discloses a method of testing and evaluating encoded message in different types of "numbers of bits character encoding formats" which shares functionality with "resource requirement of the encoded message"; and then the fewest binary bit character encoding format is selected for encoding transmitting message: figures 14-19; column 3, lines 1-50; column 12, lines 1-10, lines 15-40; column 13, lines 40-45; column 7, lines 60-67; column 11, lines 67)

Thus, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine Moskowitz's ideas of using the fewest binary bits character encoding format for encoding alphanumer message into Kim's system in order to be able to employ a well-know standard with Kim's system for saving resource and development time and also to be able to reduce memory/bandwidth consumption see (Moskowitz: column 2, lines 1-37)

Regarding claim 28:

This claim is rejected under rationale of claim 19

Regarding claims 20-21 and 29:

Those claims are rejected under rationale of claim 19

Regarding claims 24 and 30:

In addition to rejection in claims 20 and 29, Kim-Moskowitz further discloses determining a memory usage requirement of the SMS message: (Moskowitz discloses a method of evaluating and selecting the fewest "binary bit" which is equivalent to "memory usage" encoding format as a predetermined format for transmitted message: column 12, lines 1-10, lines 15-40; column 13, lines 40-45; column 7, lines 60-67; column 11, lines 67)

Regarding claim 23:

In addition to rejection in claim 21, Kim-Moskowitz further discloses determining a number of bits need to represent characters in the available format: (Moskowitz discloses a method of evaluating and selecting the fewest "binary bit" which is equivalent to "memory usage" encoding format as a predetermined format for transmitted message: column 12, lines 1-10, lines 15-40; column 13, lines 40-45; column 7, lines 60-67; column 11, lines 67)

Claims 26-27 are rejected under 35 U.S.C 103(a) as being un-patentable over Kim-Moskowitz in view of King et al. (U.S. 5,859,594)

Regarding claims 26-27:

Kim-Moskowitz discloses the invention substantially as disclosed in claim 19, but does not explicitly teach receiving message at wireless device via user interface

In analogous art, King discloses "paging terminal" which is equivalent to "wireless device" receives messages via interface: (abstract; column 1, lines 15-27)

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine King's ideas of using receiving SMS via wireless device interface with Kim-Moskowitz' s system in order to provide conveniences for users

Claim 22 is rejected under 35 U.S.C 103(a) as being un-patentable over Kim-Moskowitz in view of Murray et al. (U.S. 6,539,118)

Regarding claim 22:

Kim-Moskowitz discloses the invention substantially as disclosed in claim 21, but does not explicitly teach evaluating an English-language SMS message in ISO Latin 1, and Unicode formats as usable; and, determining the number of bits needed to represent characters in ISO Latin 1, and Unicode formats

However, in the same field of endeavor, with an analogous art, Murray discloses a system and method for evaluating character sets of message containing a plurality of character sets. Murray discloses a communication system includes "character table bank" stored in the system storage. "Characters table bank" contains many different code formats such as Unicode, "ISO-8859-1" which is equivalent to "ISO Latin 1" and ASCII. Through out the "characters table bank", the communication system performs searching, evaluation and selecting the best code format such as for faster processing, see (Murray: column 1, lines 65-67; column 2, lines 3-30; column 4, lines 32-35, 42-46, 61-67; column 5, lines 16-24; column 6, lines 60-67; column 7, lines 1-4).

Thus, It would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine Murray's ideas of code message in different code formats such as Unicode, "ISO-8859-1" with Kim-Moskowitz's system in order to determine the best code format in order to reduce bandwidth, memory utilization

Claim 25 is rejected under 35 U.S.C 103(a) as being un-patentable over Kim-Moskowitz in view of Wolf et al. (U.S. 5,844,922)

Regarding claim 25:

Kim-Moskowitz discloses the invention substantially as disclosed in claim 20, but does not explicitly teach selecting the optimal encoding format includes selecting seven-bit ASCII as a default optimal encoding format

In analogous art, Wolf discloses method of using length of 7 bit as encoding format: column 1, lines 44-46; column 2, lines 3-12; column 3, lines 15-30; column 13, lines 63-64).

Thus, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine Wolf's ideas of using constraint length of 7 is typical as encoding format into Kim-Moskowitz's system in order to be able to employ a well-know standard with Lee's system for saving resource and development time

The prior arts made of records and not relied upon are considered pertinent to applicant's disclosure. The following patents and publications are cited to further show the state of the art with respect to "System and method for optimal short message service (SMS) encoding in a wireless communications device": 20030125055; 6125281; 6421706; 20020123359; 6920331; 20020160818; 5729610; 6496543; 20030065802

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusions

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan-Dai Thi Truong whose telephone number is 571-272-7959. The examiner can normally be reached on Monday- Friday from 8:30am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bunjob A. Jaroenchonwanit can be reached on 571-272-3913. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

04/27/2007

BUNJOB JAROENCHONWANIT
SUPERVISORY PATENT EXAMINER

EM CROSS-REF. UTL 0034

Notice of References Cited	Application/Control No. 10/092,323	Applicant(s)/Patent Under Reexamination ZINK ET AL.	
	Examiner Lan-Dai Thi Truong	Art Unit 2152	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,590,887	07-2003	Lee, Hye-Young	370/342
*	B	US-5,249,220	09-1993	Moskowitz et al.	379/93.19
*	C	US-5,844,922	12-1998	Wolf et al.	714/786
*	D	US-2001/0049289	12-2001	Kim, Hoe-Won	455/466
*	E	US-5,859,594	01-1999	King et al.	340/7.55
*	F	US-6,539,118	03-2003	Murray et al.	382/229
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

APPENDIX

Related Proceedings

None